25 DECEMBER 1953

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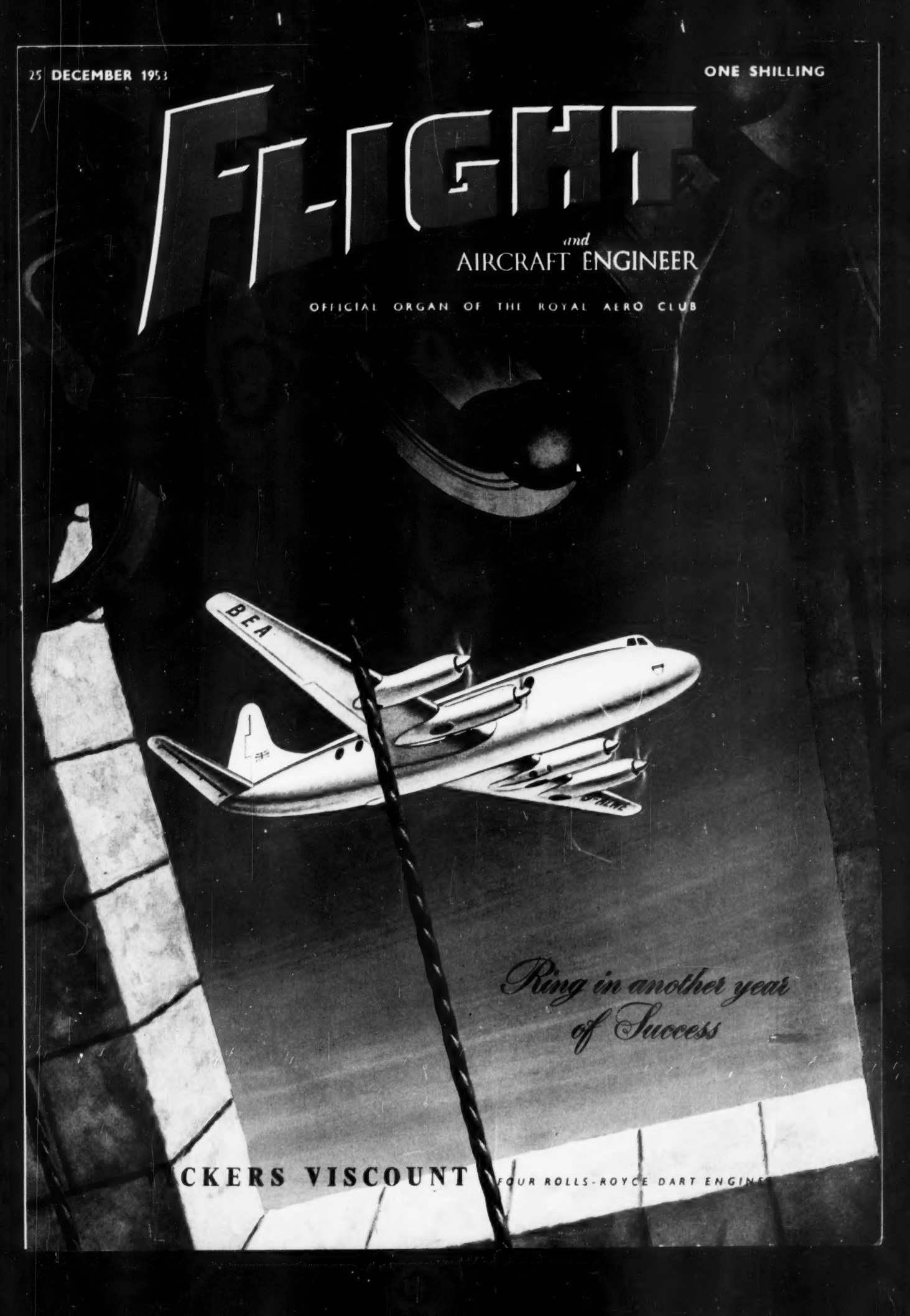

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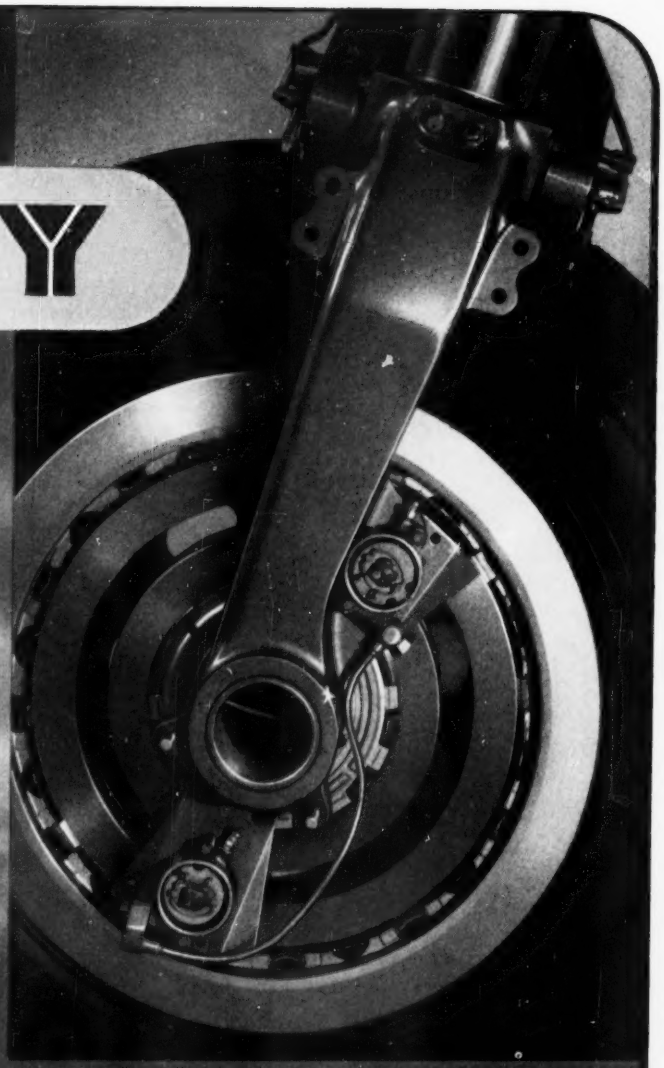

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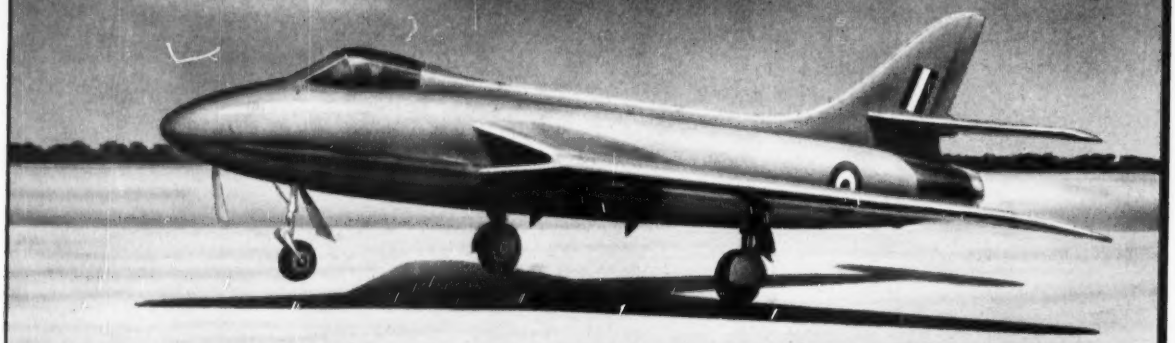

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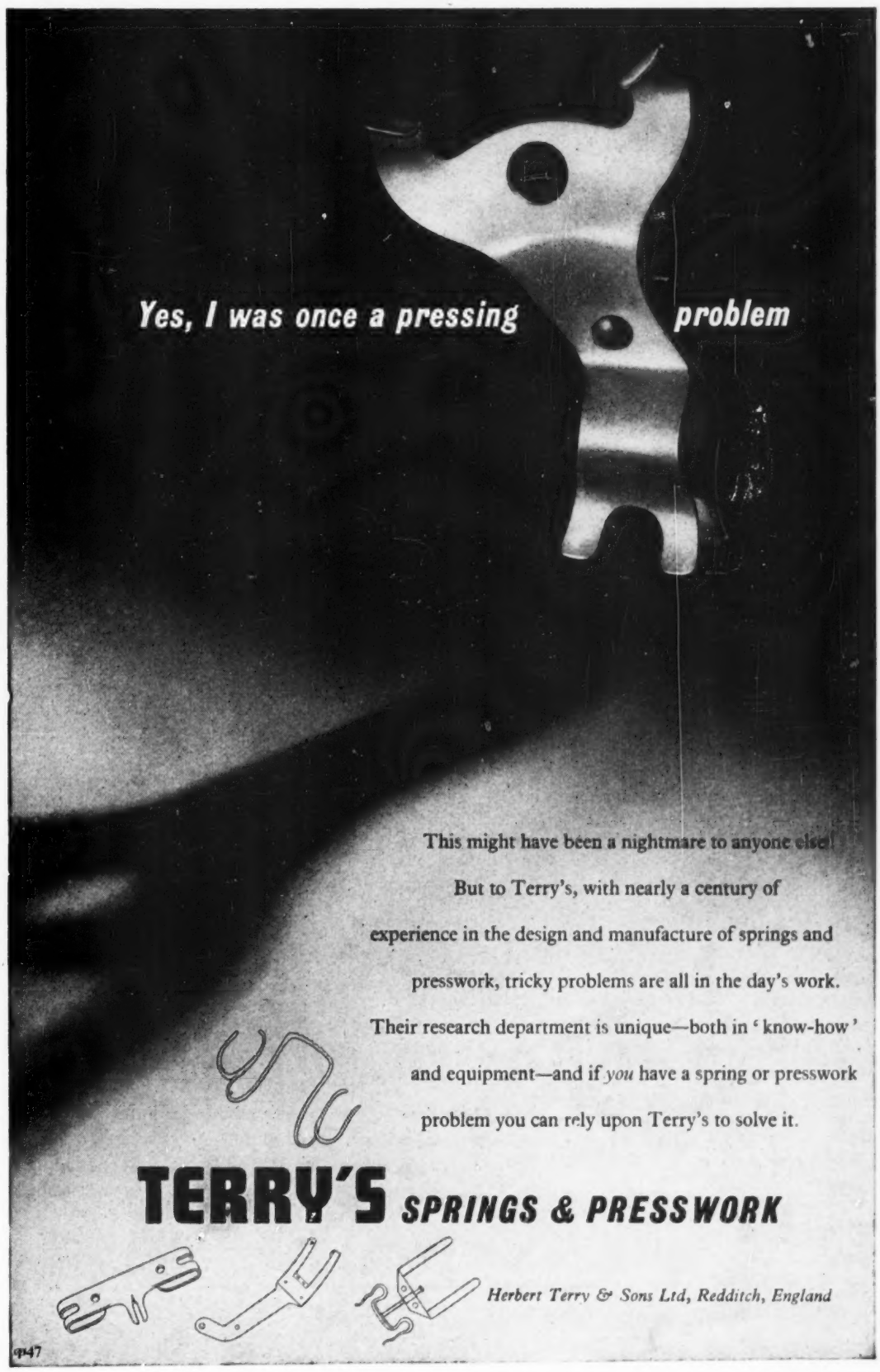
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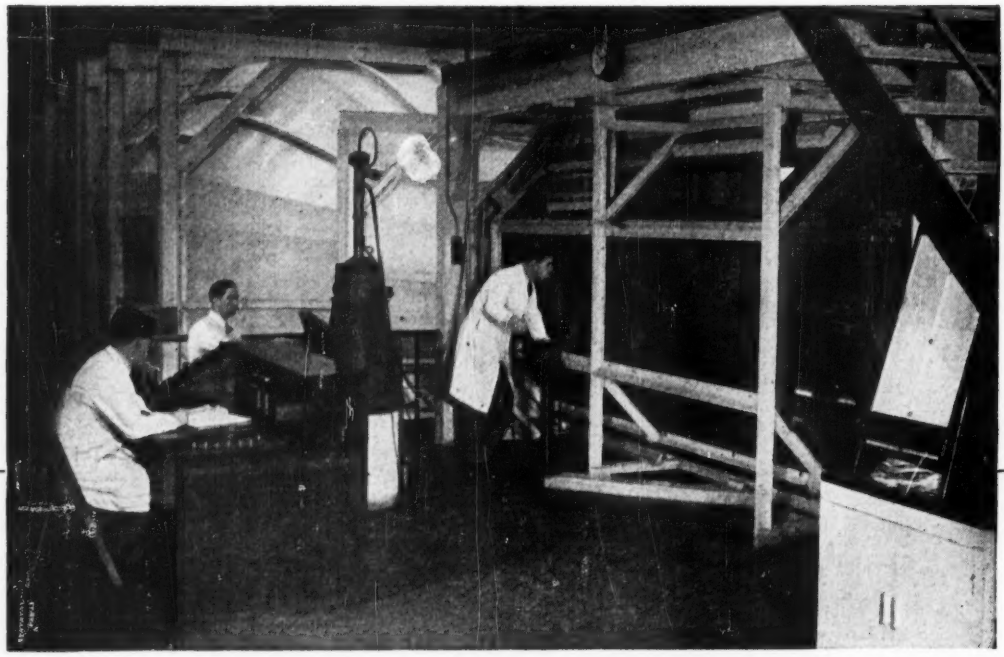

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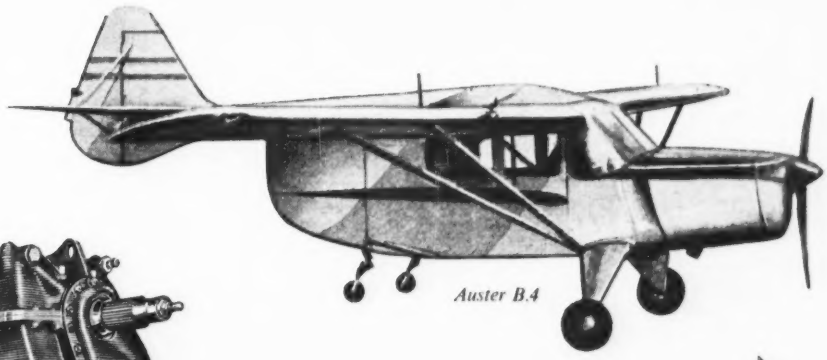

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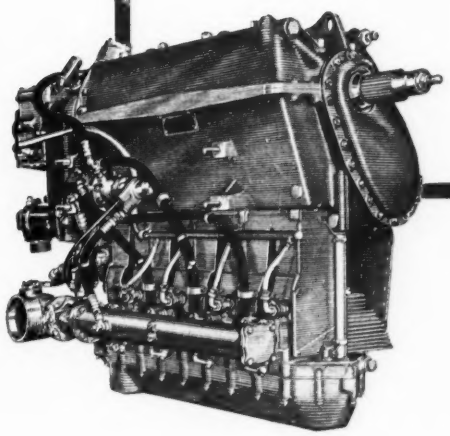

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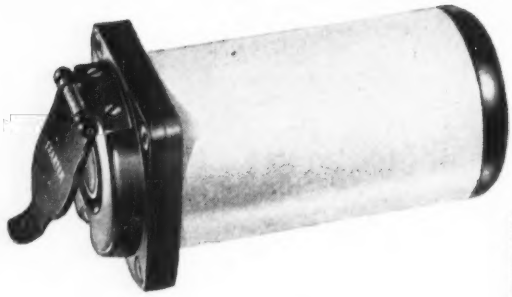

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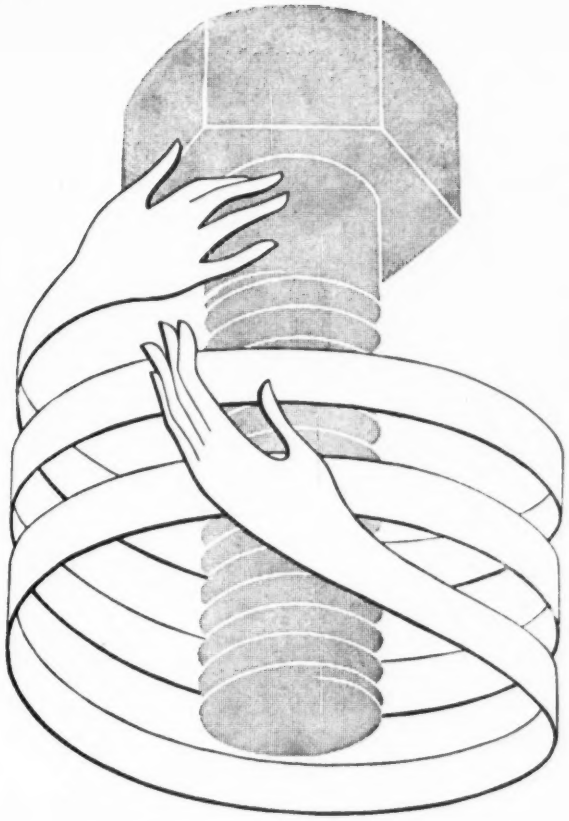

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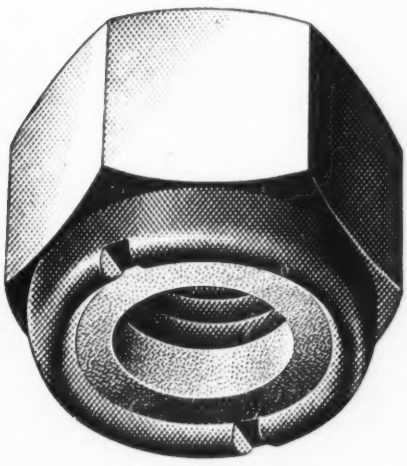

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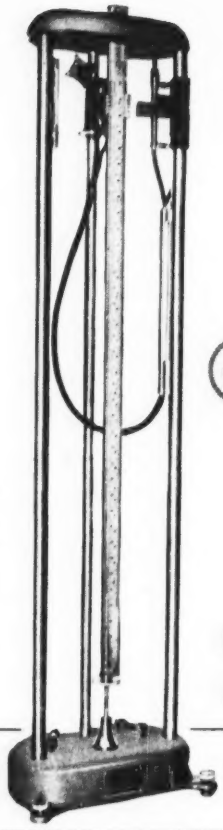

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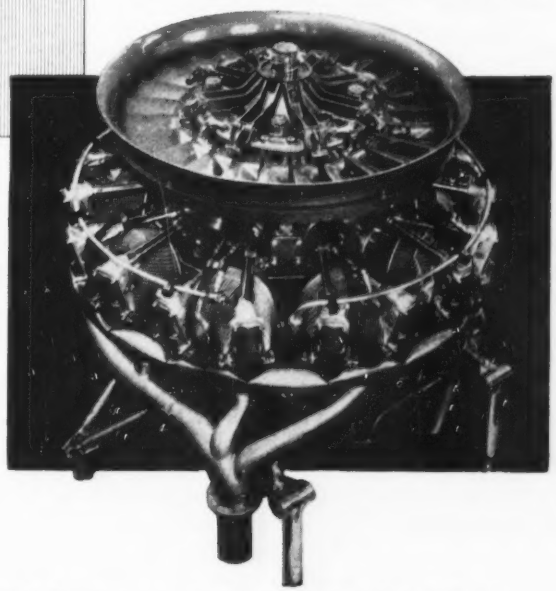

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FLIGHT
and
AIRCRAFT ENGINEER

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Founded 1909

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Position and Prospect

WITH some thoughts on the state of British civil aviation we introduce *Flight's* final issue of 1953. Seasonal sentiment dictates the choice of subject; there is, after all, an affinity between civil airliners and the furtherance of peace and goodwill. And notwithstanding the implications of many an aeronautical Christmas-card illustration, no amount of snow, holly or mistletoe can transform fighters, bombers and missiles into symbols of the Christian spirit.

British prestige in commercial aviation has grown strongly in recent years, and there is a bright prospect of further great advances by both operators and manufacturers in 1954. Certain steps forward can be prophesied with reasonable confidence. Timing will continue to be an all-important factor.

The Comet 3, for example, may well fly by midsummer. By this time, when America's first jet transport, the Boeing 707, is expected to appear, the pioneer Ghost-powered Comets will already have amassed well over 30,000 hours of actual flying experience under airline conditions. Moreover, the first members of the new Comet 2 fleet should by then be carrying the British flag over the longer ranges of the South American routes.

Progress with Britannias is watched with an impatience born of keen anticipation. Its manufacturers are faced with the parallel tasks of developing a large and promising new airframe and an equally new "whispering" turboprop power-unit. The magnitude of this project should not be under-estimated; nevertheless, it is hoped that the end of 1954 will see the second prototype Britannia well advanced in its C. of A. trials, with good prospects for introducing the type to B.O.A.C. service, on schedule, in 1955. Bristol's production capacity of two Britannias a month will be doubled (and time for delivery of new orders improved) as a result of last week's agreement to tool up for a second line at Short's Belfast factory.

If the 1953 pace of progress with the Viscount is kept up during the year ahead, Britain will go far towards winning supremacy in the two associated spheres of supplying and operating medium-stage airliners. Results achieved with B.E.A.'s growing fleet of Viscounts and the popularity of the now settled-in Ambassadors suggest that the Corporation is at last in sight of that elusive profit—though not, admittedly, in 1954.

Air France are also operating Viscounts (as well as Comets), and the first of a small fleet for Aer Lingus is due for delivery in the New Year. Viscount orders already approach the 100 mark, and this should be appreciably surpassed in 1954. Still more good news is likely to come from Vickers-Armstrongs next year, concerning not only the Viscount but its eventual successor and its pure-jet stablemate, the "1000." These are probably the most advanced of the "next generation" of transports.

Bristol's experience with the medium-sized helicopter will continue to build up through 1954, culminating in operations by B.E.A. The small tip-jet-driven Fairey Gyrodyne, soon due to begin flight-testing of the Rotodyne principal, heralds healthy competition in the commercial helicopter transport field—along two very different lines.

None of the British companies' plans for a DC-3 replacement is likely to assume tangible form next year, but in the field of light transports and feederliners the Heron promises to match the popularity of the Dove and to emulate the commercial success of the Viscount. In Scotland, work is beginning on one of the few brand-new types likely to fly in 1954—the Twin Pioneer, designed to have slow-flying qualities unique among commercial aircraft.

One of the year's most impressive achievements was the growth of the independent airlines' traffic, an overdue development which should be further accelerated in 1954. It may be that the independents' prospects could be improved still more without detriment to the Corporations, now proudly established as British flag carriers on world routes.

IN this little space we plead no cause, reproach nobody, deplore nothing. Nor do we recant, recall, remind or prognosticate. Instead, we wish our readers a Merry Christmas and a Happy New Year.

FROM ALL QUARTERS

The London Commemorative Dinner

ON December 17th, the fiftieth anniversary of powered, controlled flight was commemorated at a dinner given jointly by the Royal Aeronautical Society and the Royal Aero Club at the Dorchester Hotel, London. The Presidents of the two organizations, Sir William Farren and Lord Brabazon of Tara, received the 890 guests, who later watched the Shell film *The Story of the Century*, recording the growth of flying and its impact on twentieth-century civilization. Each of the 89 dinner tables had as a centrepiece a model of an aircraft and the scene was one of memorable brilliance.

After the loyal toast Sir William Farren proposed "The memory of the Wright brothers," and Mr. Lennox-Boyd, Minister of Transport and Civil Aviation, "The first generation." The reply was by Lord Brabazon.

Messages were received from Her Majesty the Queen and from America's Institute of the Aeronautical Sciences. Of the latter, Sir William Farren remarked how we in this country valued "the good opinion of our fellow craftsmen." The Wrights he described as "scientists, engineers, artists and airmen." In Lord Brabazon's words, one will find their equivalent in any provincial town—"people who sell bicycles and gramophones." As boys, the brothers made better kites than their companions, and sold them.

Among the guests who accepted invitations were Lord and Lady De L'Isle and Dudley, Viscount and Viscountess Trenchard, Air Chief Marshal Sir William F. Dickson (Chief of the Air Staff), Air Chief Marshal Sir John Baker (Controller of Aircraft, M.o.S.) and Lady Baker, Vice-Admiral Sir Edmund Anstice, Sir Alliot Verdon-Roe and Brig.-Gen. J. M. Stirling (the newly appointed American Air Attaché). A report will appear in our next issue.

Cape Town Record by Canberra

A CANBERRA has provisionally been timed between London and Cape Town at 12 hr 21 min 3·8 sec—representing a speed of 486·6 m.p.h. for the 6,009 statute miles. The aircraft, a B.2 piloted by W/C. G. G. Petty and navigated by S/Ls T. P. McGarry and J. McD. Craig, left London Airport at 0001 hr G.M.T. on December 17th and reached Cape Town at 1222 G.M.T., stopping at Castel Idris (18 min) and Brazzaville (23 min). Take-off for the return flight (with W/C. A. H. Humphrey, S/L. D. Bower and S/L. R. F. B. Powell as crew) was delayed by fog at London Airport.

Also on December 17th, the winning New Zealand Race crew flew their P.R.3 Canberra to Kitty Hawk, North Carolina, where they took part in the 50th anniversary celebrations.

Dutch Aircraft Output

THE way will shortly be cleared for production in Holland of the 460 Hunters ordered "off-shore" there. Fokker, at their factory at Schiphol, are completing their orders for 330 Meteors, the last units now being in the jigs. Of this total, the odd thirty were for supply as components to Avions Fairey in Belgium. Hunter production will be shared to some extent with the Aviolanda and de Schelde companies.

It may be recalled that the Fokker company, since the war under State control, has now been returned to private ownership.

New M.o.S. Guided-Weapons Posts

INDICATIVE of the constantly increasing volume of guided-weapon work in the Ministry of Supply is the establishment of new senior posts, announced last week by the Minister, Mr. Duncan Sandys.

The existing post of Principal Director of Guided Weapons is abolished and is replaced by two new posts: the occupant of one will be designated Principal Director of Scientific Research (Guided Weapons and Electronics); of the other, Director-General of Guided Weapons.

Dr. R. Cockburn

Mr. J. E. Serby

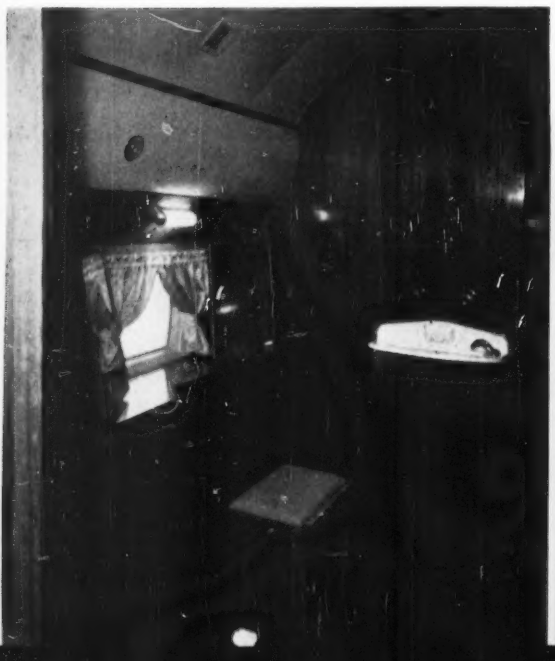
The Principal Director will be responsible to the Controller of Guided Weapons for the general overseeing of research and technical assessment in guided-weapon and electronic work, but in specifically research matters he will be responsible to the Chief Scientist. The Director-General will attend to general co-ordination of the current research and development programme.

Selected to fill the post of Principal Director is Dr. R. Cockburn, C.B., O.B.E., who is at present Scientific Adviser to the Air Ministry.

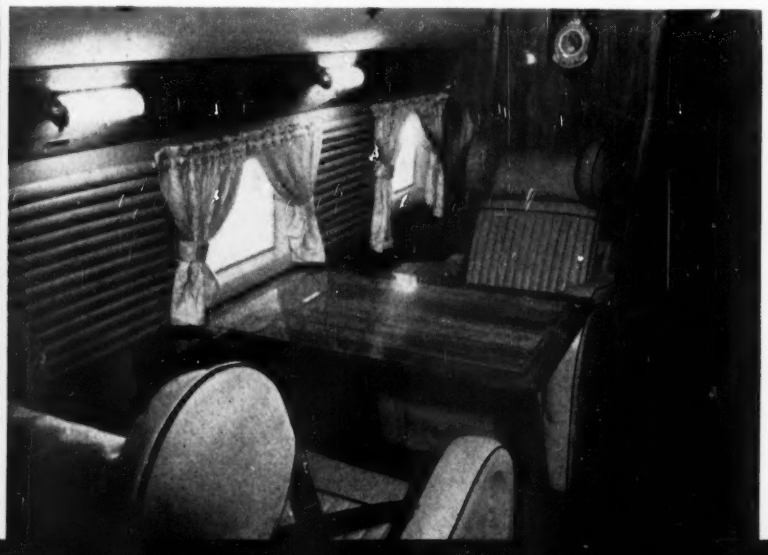
The Director-General will be Mr. J. E. Serby, C.B.E., now Deputy Director of the Royal Aircraft Establishment. He will be succeeded at Farnborough by Mr. M. B. Morgan, the present head of the R.A.E.'s guided-weapon department.

The Production Conference

THE second conference of the Institution of Production Engineers was held at the University of Southampton from December 18th to 19th. The subject this year was "Problems of Aircraft Production" and three papers were read, entitled *Trend of Design, Production Problems Arising from the Trend of Design*, and *User Problems Affecting Industry*. Summaries will appear in a forthcoming issue of *Flight*.



ROYAL DAKOTA: Interior views of the R.N.Z.A.F. Dakota in which the Queen and the Duke of Edinburgh will make six flights during their tour of New Zealand. The Queen's dressing-room (left) has two built-in wardrobes and a full-length mirror. In Her Majesty's cabin (right), the fittings of which are based on those of a Queen's Flight Viking, much use is made of native woods.



Faster, Higher . . .

AT an American Aero Club dinner held on December 17th, the anniversary of powered flight, President Eisenhower was expected to announce the actual speed and altitude of a new record flight.

Over the Mojave Desert, California, on December 12th, Major "Chuck" Yeager had flown the Bell X-1A rocket research aircraft at a speed believed to be over 1,600 m.p.h. and at a height of 80,000ft.

The last such record to be officially confirmed by N.A.C.A. was 1,327 m.p.h. at an unspecified height, set by Mr. Scott Crossfield in the U.S. Navy's Douglas Skyrocket on November 21st.

Major Yeager's latest achievement in the X-1A (a photograph of which appeared in *Flight* of December 4th) represents a Mach number of about 2.5, equivalent to 27 miles a minute.

These achievements, important though they are, cannot of course qualify as official world speed records, because of the height restrictions which still apply to such attempts. It can nevertheless be rightly claimed that Major Yeager is now once again the fastest man on earth. He qualified initially for this title on October 14th, 1947, when he first exceeded the speed of sound in the Bell X-1, predecessor of the present X-1A.

Records for Ambrosini

AT Ciampino Airport, Rome, on December 5th, an Ambrosini Super VII flown by Ing. G. A. Ferrari set up two new closed-circuit records for aircraft in category C-1-c (light aircraft, 2,205-3,855 lb a.u.w.). In the 100 km closed circuit, the speed attained was 260.664 m.p.h. (419.482 km/hr), the previous record having been set up in 1951 by Italy with the earlier Ambrosini S. VII at 222.848 m.p.h. (358.637 km/hr).

In the 500 km closed circuit, the speed was 255.848 m.p.h. (411.701 km/hr), breaking the 1951 record set up by Russia with a Yak 18 at 156.479 m.p.h. (251.823 km/hr). The new records have yet to be confirmed by the F.A.I.

The Super VII is powered by a D.H. Gipsy Queen 70-4 engine of 340 b.h.p. driving a D.H. airscrew.

Britannia Production at Belfast

ALTHOUGH the period from design to first production delivery of Britannias looks like being creditably short, some concern has been felt about the rate at which these large aircraft could be produced and delivered by Bristols to meet the substantial orders expected. The important announcement made last week that a second assembly line is to be set up at the Belfast factory of Short Bros. and Harland, Ltd., sets such fears at rest. The parent company has issued a brief official statement to the effect that an agreement has been made with Shorts to prepare capacity for production of the Britannia at Belfast, and it is learned that the plan will eventually provide for a duplication of Bristol production at Short's factory.

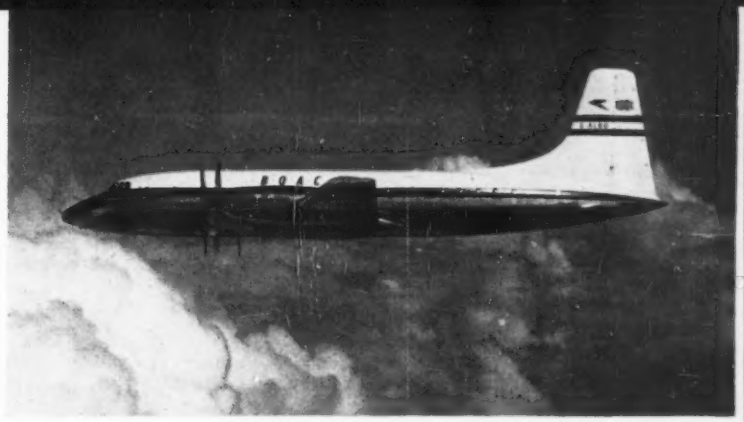
Bristol's capacity is about 25 Britannias a year, and in addition they will now produce components—up to 50 per cent—for assembly with Short-built parts on the new line. Shorts may in turn reciprocate by exporting other components to Bristol. The first Belfast Britannias should leave the production line during 1956. The agreement does not entail an order from Bristols for a definite number of aircraft; instead, it provides for the integration of Short's production capacity with that of the parent company, so increasing the potential output and permitting quicker deliveries.

Additional official information is that an exchange of information and drawings has already taken place and the preparation of an assembly area in Short's works is in hand. Substantial additions will be made to the erecting shops at Belfast where, as we recently mentioned, Canberra and Comet production is under way in addition to a good deal of other work involving the company's own aircraft. This work will not be affected by the new plans.

It is not yet known to what extent the maritime-reconnaissance version of the Britannia, which is to be built in Canada, will differ from the civil transport; but the aircraft will be similar enough for the products of the Canadair Company at Montreal to be reasonably regarded as a third Britannia production line.

So far 33 firm orders have been received for Britannias, all for B.O.A.C. They provide for fifteen Mk 100s, ten Mk 300s, five Mk 250s and three of one or other of the long-range types. In addition, B.O.A.C. have a provisional order for two more aircraft to bring the total to 35. Qantas have issued a letter of intent for six Britannias, and the Bristol company have indicated that seven other airlines are negotiating with a view to ordering fleets. Their orders together would total 51 aircraft, bringing the potential figure to 92. The seven "other airlines" have not been named, but had any of them been American we believe the fact would have been disclosed.

B.O.A.C. expect to receive their first aircraft at the end of next year and to put them in service during May of 1955. The Britannia prototype, which is part-furnished, has carried, among others, B.O.A.C. and Qantas representatives and—not without interest—the A.O.C-in-C. Transport Command, Air Marshal C. E. N. Guest. The second Britannia was to have made its first flight last week, but so far weather has not been suitable. It will almost certainly have flown by the time these words are read.



THE BRISTOL BRITANNIA, orders for which—firm and potential—are approaching the hundred mark. As recorded below, an assembly line is being inaugurated at the Belfast works of Short Bros. Ltd.

The first few Britannias for B.O.A.C. will have Proteus 705 engines, but Proteus 755s will supersede them as soon as they are available. The 755 differs only in detail, having minor modifications to reduction gear and bearing cooling, but it does make provision for cabin pressurization by tapping its compressor. The first Britannias will be fitted with Godfrey blowers. The power output of the Proteus 705 (which is derated) is 3,250 s.h.p. plus 1,200 lb thrust, equal to 3,680 e.h.p., and of the Proteus 755, 3,650 s.h.p. plus 1,200 lb thrust, equal to 4,150 e.h.p.

In Memory of C.G.G.

A MEMORIAL service for Mr. C. G. Grey has been arranged at Christ Church, Down Street, London, W.1, for 12 noon on January 13th. The funeral took place privately on Monday, December 14th. Only members of the family were present and there were no flowers by request; it is the wish of the relatives, however, that donations may be sent to the R.A.F. Benevolent Fund.

R.A.E. Recollections

THE Royal Aircraft Establishment first occupied its present site (as the Royal Aircraft Factory) in 1904. Thus it was almost a 50-year anniversary for the R.A.E. itself when, a week last Monday, a dinner was held to mark the anniversary of the Wright brothers' historic flight. On the anniversary occasion, members of the Establishment's senior staff met to entertain many of the pioneers who had known and worked at Farnborough in its early years. The only "interlopers" (to quote Mr. A. A. Hall, M.A., F.R.Ae.S., R.A.E. director and chairman for the evening) were Sir James Helmore and Sir Henry Tizard—and also, it may be added, a discreet brace of journalists.

The Director's Mess, where the dinner was held, had been specially decorated for the occasion with photographs, models, lampshades made from old photographic prints—and with impeccable taste. Outside the entrance stood B4897, a genuine, full-size S.E.5A, while inside, after an excellent dinner had been enjoyed, Mr. Hall proposed the health of the guests.

Although some of the distinguished men invited had been unable to attend, he said, the early pattern of progress in British aviation had been formed to a large extent by many of those present. After reading extracts from an historical document entitled *Orders for the Guidance of Heads of Departments* ("All complaints are to be made in writing to the Instructor in Ballooning"), the director went on to outline the significance of the Wrights' flight and to mention some of the Establishment's early designs and experimental work.

A fascinating film, taken in 1908 and showing a number of flights by Wilbur Wright and Col. S. F. S. Cody, was next shown. Odd snatches of additional information could be heard as guests identified themselves or their colleagues in particular scenes. A number of impromptu reminiscences of the early days were then given by various people, recollections which were no less amusing and interesting to a writer who was not yet born at the times described. Particularly emphatic impressions were recalled by Sir Melvill Jones, Sir George Thomson, Sir Henry Tizard, Sir Geoffrey Taylor, Major F. M. Green, and Sir William Farren (who described how he was once sacked from R.A.E. but held no grudge against anyone—in fact, it had proved a most progressive step).

After a second film had been shown, illustrating aircraft types and scenes of the 1920s, discussion and reminiscence continued. "Those were the days" had indeed been the evening's theme.

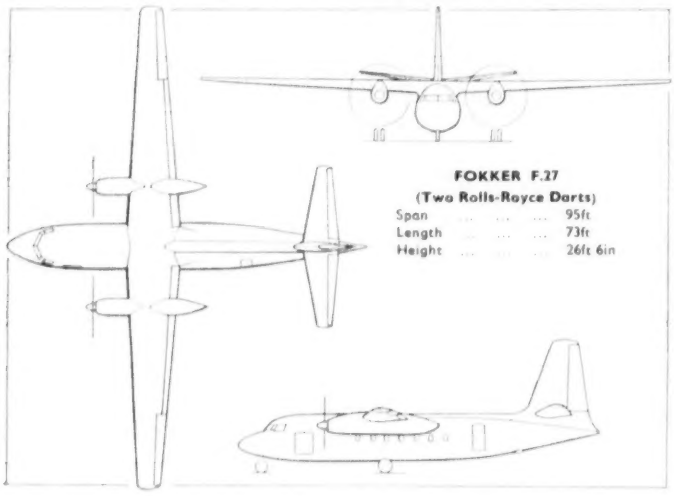
Work Starts on the Fokker Friendship

IT is now nearly a year since the original artist's impression and outline drawing of the Fokker F.27 Friendship appeared, and several developments have taken place in the meantime. The most important was the placing, last September, of an order for two prototypes. In fact, the order is for almost three, the parts of the third being required for structure and other testing on the ground. According to the contract the two flying prototypes must be delivered to the Dutch Government by September 1955, but Fokker hope and expect to do considerably better than this. Prototype parts are beginning to move in the factory.

A second important development is the introduction of the Rolls-Royce Dart RDa.5 of 1,550 s.h.p. The original Friendship was planned around two RDa.3s.

As may be seen from the new general-arrangement drawing on this page, there has been considerable alteration to shapes, though mainly of a superficial nature. In particular, the tailplane position will be noted, as will its dihedral. A longer, more shapely, nose will house a forward-folding nosewheel which is to be mounted in front of the pressure bulkhead.

Some eighteen months of wind-tunnel work now lies behind the aerodynamic design, and it remains only to settle the exact configuration of the special high-lift flaps. These are designed to give a lift coefficient of better than 3.



As the Friendship is of high-wing configuration some extra strength is being built into the floor for protection in the event of a wheels-up landing. Stiffening members are incorporated, broadly speaking, as longitudinal skids, and strong seat-attachment rails are to be fitted in conjunction with them, so providing for paired rearward-facing seats stressed for 25 g.

Since the first design-studies were put on paper and a mock-up made, cabin-width has been increased by 10 cm and a comfortable aisle separates the pairs of seats on each side. Oval windows are seen in the mock-up, and a particularly roomy cockpit has very large forward screen panels.

Originally some kind of de-icing boots were in mind for the wings, but a study of available equipment has caused Fokkers to turn to a thermal system, similar to that on the Viscounts, to preserve the clean laminar wing form.

The Friendship is planned as an "all-pneumatic" aircraft, following experience and experiment with pneumatic systems on other recent Fokker aircraft. Considerable use will be made of the Redux process in construction, except where double curvatures are involved.

Provisional data calculated for the Friendship have been based mainly on the Dart RDa.3s of 1,400 s.h.p. plus 265 lb thrust. With the more powerful RDa.5s the weight will probably be 32,000 lb to 33,000 lb on introduction, and an economical cruising speed of at least 250 m.p.h. can be expected at over 20,000ft with 28 passengers. There is also promise of good small-field characteristics, the take-off and landing runs being about 1,250 yards.

Mention has been made of the possibility of a cargo version of the F.27, to be named the Freightship. An alternative to the turboprop Darts is a piston engine of the Hercules or Twin Wasp type. All-up weights with these engines would be much the same as with the Dart, but the empty weight would be some 4,000 lb more with proportionate loss in baggage and freight load. Cruising speeds and altitudes would be about 10 m.p.h. and 5,000ft less, respectively.

Many operators who today might choose piston-engine power but are watching the position with regard to this class of aircraft—the DC-3 successors—feel that, by the time types such as the F.27 are ready for service, turboprops will have improved both in themselves and in their public appeal to an extent which will render the piston alternative obsolescent and unattractive. The impact of the Vickers Viscount upon European routes has already indicated that such a possibility exists.

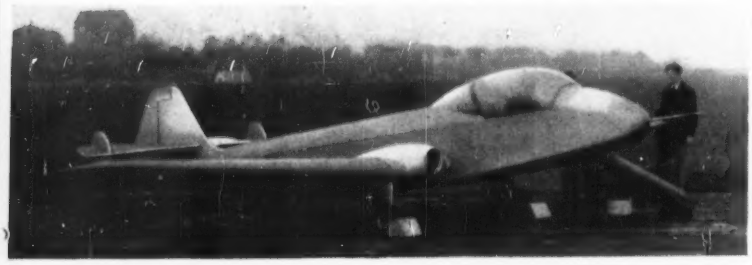
SPARROWJET TAKES THE AIR

AIR-RACING enthusiasts constantly deplore—and with reason—the lack of variety in the aircraft which regularly compete in events in this country. Next season, however, they are likely to see at least one machine differing very widely from the usual run, for the Miles Sparrowjet—Mr. Fred Dunkerley's Sparrowhawk G-ADNL in new guise, rebuilt with two Turbomeca Palas turbojets—has at long last taken the air.

The Sparrowjet's first flight was made at Shoreham Airport on December 14th with Mr. George Miles as pilot. He is chief designer to F. G. Miles, Ltd., who carried out the conversion.

When first registered in 1935, G-ADNL was powered with a high-compression Gipsy Major engine and, though built as a two-seater, had the front cockpit faired in for racing purposes. All-up weight was 1,700 lb. The reconstruction process has been an extensive one, and the machine, now designated the Miles M.77, bears very little resemblance to the M.5 of 18 years ago.

Baby jet twin : The Miles Sparrowjet at Shoreham.



The pilot, under a bubble canopy which should give excellent view, occupies the position of the original single engine, and the two little turbojets, of 330 lb thrust each, are accommodated in the wing-roots, inboard of the wide-track trousered undercarriage. Except for a flattened tip, the rudder retains approximately its old and characteristically "Milesian" shape, but the tailplane now carries two small fins.

All-up weight is 2,400 lb (1935, 1,700 lb). Wing span is 31ft 11in (28ft) and overall length 27ft 7in (23ft 6in). "Speeds in excess of 250 m.p.h." are expected; the Sparrowhawk was capable of about 180 m.p.h.

F. G. Miles, Ltd., state that the Sparrowjet has been "designed for racing and research flying, with particular reference to the suitability of this type of aircraft as a primary trainer."

"MAGNIFICENT SHIP"

A VERY graceful tribute to a British turboprop airliner appeared in print last week—and from an American citizen at that. Mr. J. Hanaghan, of New York, wrote these words to *Picture Post*:—

"All this talk of British air supremacy I considered strictly for the birds—until a few days back. It so happens I jumped one of your Viscount turboprop jobs at London Airport for Nutts Corner, Belfast. I was taking my youngest over to see the old folks in Northern Ireland. He is only 14 months, and not too steady on his feet. At 25,000ft he was romping up and down the aisle between the comfortable seats in the Viscount. No vibration, no noise, hardly time enough to settle in and drink the cup of coffee and sandwiches provided, before we were there. The stewards were justly proud of the magnificent ship. Now I believe there is something to this British claim."

UNPRODUCTIVITY

New Hope for the Aircraft Industry: the Case for Inefficient Manpower-usage

By PHISBEE Z. McGILLICUDDY

THIS article is a fortunately abridged version of the paper "Towards Unproductivity," which formed this year's presidential address to the Loyal Aphronautical Society of Great Britain (Walthamstow branch). The author, and president of the Society, Professor Phisbee Z. McGillicuddy, has for many years been interested in unproductivity, while remaining uninterested in productivity, and is thus admirably qualified. Until recently he was Special Adviser to the British League for Unproductive and Retrospective Panel-beaters (B.L.U.R.P.), and is at present head of the department of unproductive projects at the M.T.C.A. (Ministry of Terribly Complicated Aviation).

TOWARDS UNPRODUCTIVITY! Well might this clarion call go forth to stir the imagination of the youth of this country's aircraft industry. For without unproductivity, the Masefield airline-efficiency trend has shown (and any trend of Masefield is a trend of mine) that an inevitable drift will occur towards that evil of the 1940s, productivity, with all its attendant curses and problems. Economically, financially, logically and inescapably, the tendency towards non-observance of the optimum-efficiency-criterion as applied to the peak-output learning-curve function must have an immediate marginal energy-increase application, whatever that might mean.

But how, you may ask, does this affect Britain's aircraft industry? I shall tell you. According to the proponents of productivity, experience shows that in many cases of long runs of aircraft manufacture involving an aircraft type which remains substantially the same during the production period, there is a steady reduction in the man-hour content which varies with the cumulative quantity produced. What the productionists have overlooked in the midst of all their jargon, however, is that the reason for the decrease in man-hours is that the personnel engaged in the work-function occupy a shorter number of time-units in the manufacture of the aircraft-commodity. This should be obvious or, at any rate, obscure.

The exponential man-hours reduction curve is, believe it or not, asymptotic to infinity at zero items made. But as production operatives have come to realize, leaning over backwards and trying to remain asymptotic to infinity is quite a strain, no matter how many items may, or indeed may not, have been made.

"But," the productivity experts say, "the cumulative aircraft having the man-hours which are the average for its batch will be found by multiplying the number up to the particular batch by the cumulative number included to the completion of the batch and taking the square root of this product." This is most unlikely.

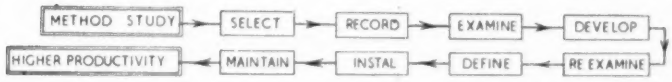
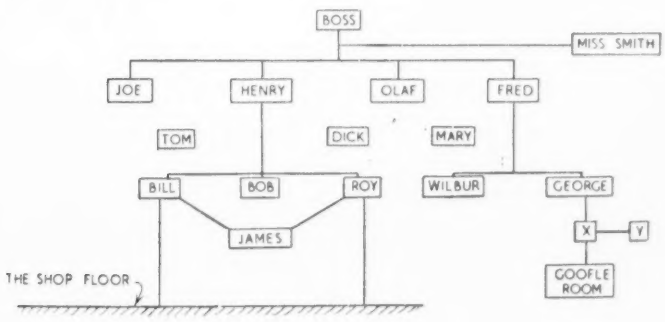


Fig. 1. The conventional approach: "Illogical," McGillicuddy claims.

Let us now turn imperceptibly to the diagrams. Fig. 1 shows the conventional plan in which method-study is used to achieve higher productivity, with all its attendant futilities.

The obvious unsuitability of this scheme for modern conditions is matched only by its inherently illogical and introspective structure, or something very much like that. It is seen that, by this method, one ends up very nearly where one began (at the left-hand side of the diagram). Have they no ambition, these people?

Yes. Their ambition, if we may call it an ambition, is to achieve Improved Factory and Workplace Layout, Improved Design of Equipment, Better Working Conditions, and Reduction of Fatigue, resulting in Improved Use of Material, Plant, Equipment and Manpower, while constantly struggling towards Higher Productivity the while. Really, gentlemen, how complicated can you get?



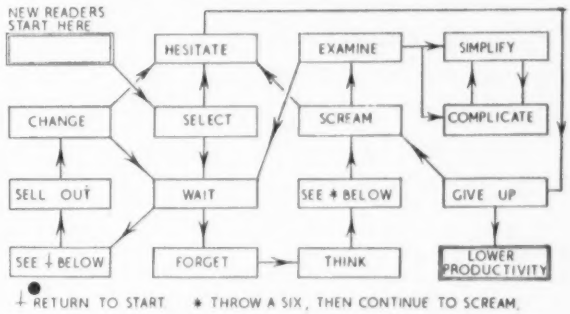


Fig. 2. The McGillicuddy plan for Lower Productivity. With flexibility and decision come lower overheads: fewer high-productivity experts.

Consider now the unproductivist system, as indicated with clarity and high-grade printer's ink, in Fig. 2.

We have, of course, no method-study in the unproductivist approach; indeed, some have gone so far as to assert that we have no method *to* study. Be that as it may, we have the blank space (top, left) in which would appear our equivalent of method-study had we thought of a suitable word. [*Any suggestions from readers?*—Ed.] Obviously, the scheme is ideal. It has both flexibility (after selecting, one can either wait, or hesitate), and decisiveness (after hesitating, one must give up—an unbeatable combination.

How is the system applied in practice? Consider the departmental organization of a typical aircraft firm, as shown in Fig. 3 below.

Now Joe, Henry, Olaf and Fred are directly responsible to the boss. The boss in turn is responsible to the Board and has, in addition, one other liability. Her name is Miss Smith. Tom and Dick are not responsible to anyone (in fact they're two of the most irresponsible people in the works). As nobody is responsible to them either, they have, all things considered, quite a nice number. *Her* name is Mary.

George was in charge of the Goofle Room, but has now delegated his authority to X, who is a man with one arm called Charlie. The person shown at Y appears only at times like this to ask what the name of the other arm is.

This, then, is unproductivity. To summarize briefly our basic philosophy, we may state that the systematic pre-determination of unproductive objectives must imply the most inefficient expenditure of time, human energy and material resources, i.e.:—

Lower Productivity means Fewer High-productivity Experts;

Fewer High-productivity Experts mean Lower Overheads;

Lower Overheads mean More Profits;

More Profits mean Less Effort;

Less Effort means Fewer Aircraft; and

Fewer Aircraft mean Lower Productivity . . . .

Ingenious, isn't it?

Fig. 3. In industry, simplicity. Organizational structure of a typical aircraft firm using modern unproductivity techniques. Lines of authority are clearly shown, while highly technical details are discussed in the text above. (No workers on shop floor, due to strike.)

A PIGEON IS AIRBORNE: Admirable from an æsthetic standpoint, these remarkable flashlight photographs by E. O. Hoppé, F.R.P.S., F.R.G.S., will also be of interest to those who study the aerodynamics of bird-flight. The take-off picture shows to advantage the extended alula, or winglet, which is believed to smooth the airflow over each main wing-surface, thus postponing the stall and increasing lift, in the manner of the Handley Page slot.

HERE AND THERE

From Australia by Auster

MR. HUBERT SHOWELL, who recently flew his Auster on a business trip to Australia, began his homeward journey on Thursday of last week. He completed the accident-free outward trip in a month.

India's Ouragans

THIRTY-NINE of the 71 Dassault Ouragans ordered by the Indian Government have now been delivered, 35 in the French aircraft-carrier *Dixmude* and four ferried by I.A.F. pilots. Mr. Mahavir Tyagi, Minister of Defence, said in New Delhi last week that the aircraft would cost 653,000 rupees (about £50,000) each.

U.S. North African Base Abandoned

THE U.S.A.F. is not to proceed with construction of its base in the Safi area on the Atlantic coast of Morocco. Of the five North African bases originally planned, three are operating and a fourth is under construction.

Unfair to Redheads?

"AMPLE storage space for books, blankets, etc., has been incorporated in the bulkhead and in the beautifully finished blonde cabinets . . ."—from a brochure describing a luxuriously equipped Douglas B-23 converted for use as an executive transport.

Wisdom about Helicopters

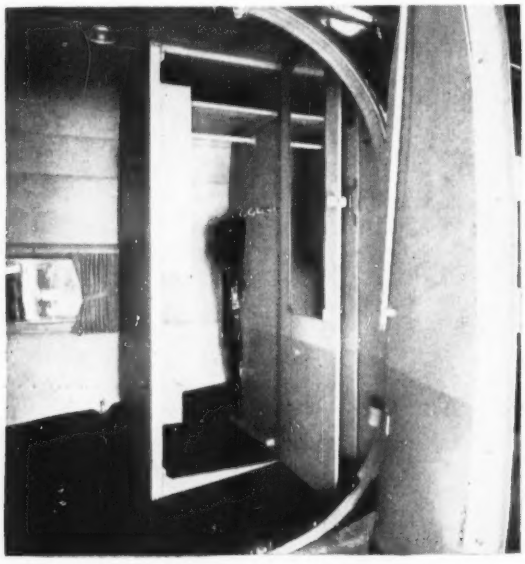
MEMBERS and friends of the Helicopter Association are to hold a brains trust on Friday, January 22nd, in the R.Ae.S. Associates' Library at Londonderry House. The team will consist of Mr. R. Hafner (Bristols), Mr. L. G. Frise (Percivals), Mr. J. Shapiro (consultant), Mr. R. H. Whitby (B.E.A.) and Mr. K. Reed (Saunders-Roe); the question-master will be Maurice A. Smith, editor of *Flight*.

South Africa Sees an S.55

BELIEVED to be the first helicopter of its type to visit South Africa, the Westland-Sikorsky S.55 that is to act as spotter to the Norwegian whaling fleet in the Antarctic landed at Durban on December 7th. It had been flown ahead of the factory-ship *Norhval* for a gyro-compass adjustment and engine check by the S.A.A.F.

Trophy Tells a Story

AN industrial savings trophy presented to the South Ayrshire Local Savings Committee by Mr. D. F. McIntyre, managing director of Scottish Aviation, Ltd., bears this inscription: "The base is made of a piece of spruce wood from the main spar of a Fokker F.22 aircraft G-AFZP. The aircraft was one of three purchased by Scottish Aviation and flown by them from Holland on the eve of the outbreak of war in 1939 to save their falling into the hands of the Germans. All three aircraft were then extensively used as flying classrooms for the mass training of navigators at Prestwick, where, during 1939-41, more than fifty per cent of the R.A.F. intake of navigators received their training."



ACCOUTREMENTS of the admiral and his staff are accommodated in the special wardrobe compartment of the Percival Sea Prince C.2 Admiral's Barge; there is a sword rack, and even stowage for medals. We illustrated the aircraft last week.

Power Jets Director to Leave

THE Board of Power Jets (Research and Development), Ltd., has "reluctantly agreed" to Mr. W. E. P. Johnson relinquishing his joint managing directorship in order to develop his interests as a consultant. Mr. T. G. Hicks, who shared the post with him, now becomes managing director.

Model Membership

MODEL-FLYING enthusiasts who are not members of model clubs may now join the Society of Model Aeronautical Engineers under a new associate-membership scheme. Details are obtainable from the S.M.A.E. at Londonderry House, 19 Park Lane, London, W.1.

History on Show

OVER 100 enlarged photographs of the men, machines and events that have made aviation history, and 30 models, are included in a powered-flight jubilee exhibition at 95-97 Regent Street, London, W.1. Organized by the *Evening News*, the display is open (9.30 a.m. to 5 p.m. Monday to Friday, 9.30 a.m. to noon Saturday) until January 9th.

Unhonoured and Unsung?

HOLDER of a pilot's licence until the age of 72, 74-year-old Mr. James Y. Watson, of Blairgowrie, Perthshire, claims that he built and flew an aeroplane six months before the Wright brothers did so. He says that the flights were made at Belmont, Dundee, with a 10 h.p. engine from a Santos-Dumont dirigible. Last week he was planning a journey to London in order to lay his evidence—photographs, and letters from a number of people who assisted in the work—before the Royal Aero Club.

I don't give two hoots for your Owl Patrol, said the M.D. testily. My little lot have won more badges for drilling in odd corners, screwing up the inscrutable, nut running, gun running, rum running and showing old ladies under buses . . . Good turns? Me newest tenderfoot does them at the rate of 1,000 a minute.* I am happy, nay proud, to be their dear old scout master —

'*Old master is right*', said a little horror in very long shorts. At least that's what we thought he said.

* The old boy seems to be referring to the latest Desoutter straight drill, a ½" model weighing only half as much as other tools of similar capacity, with speeds of 1,000, 550 and 370 r.p.m.

'*Morse, of course*', *said the Little Horse.*

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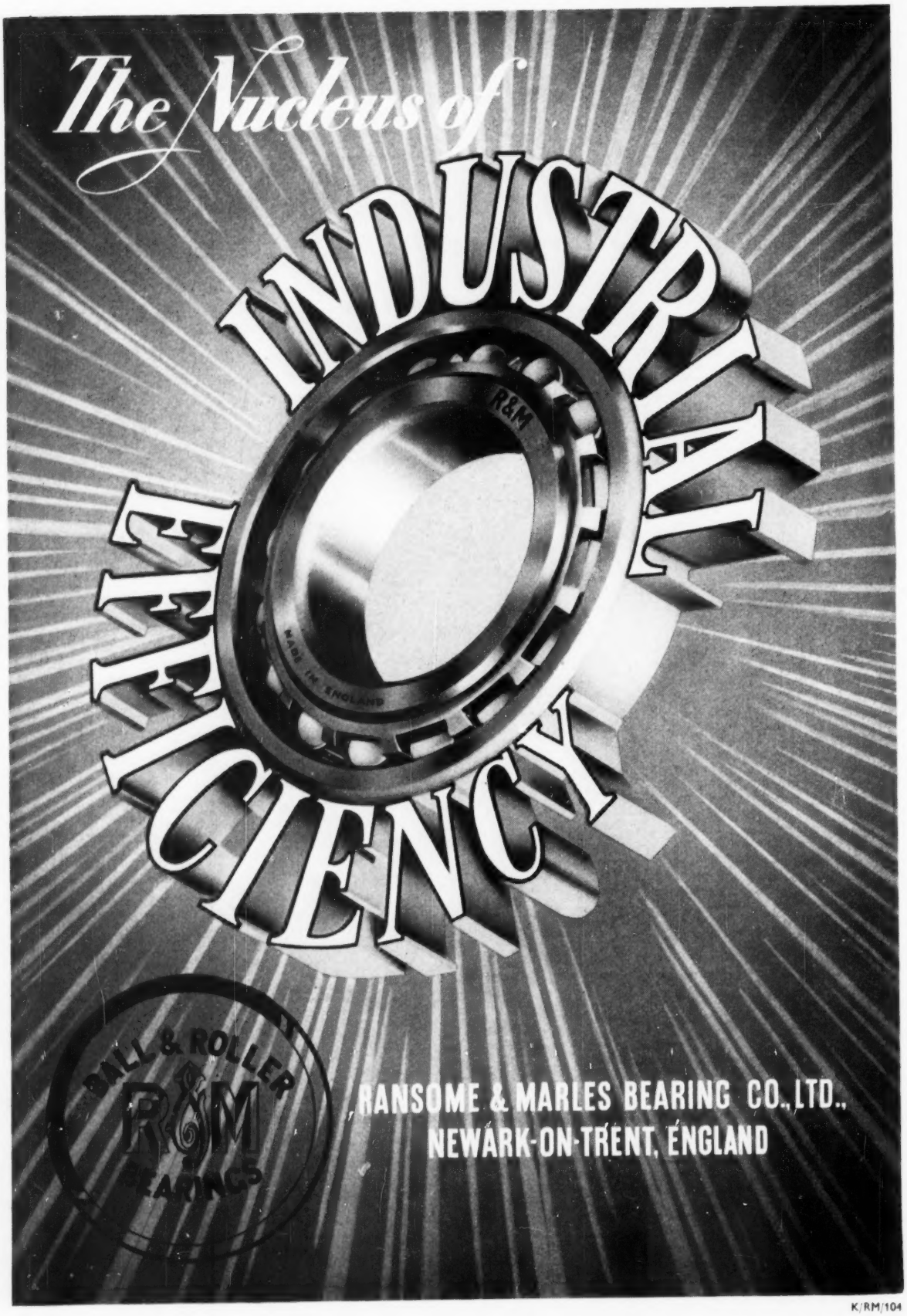
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THE WORK OF THE WRIGHTS

Background to their Activities Described in a Lecture by Capt. J. L. Pritchard

THE pioneering work of the Wright brothers was described by Captain J. L. Pritchard, C.B.E., Hon.F.R.Ae.S. (late secretary of the Royal Aeronautical Society), before the Royal Society of Arts on Wednesday, December 16th. In his paper, *The Work of the Wright Brothers for Aviation*, he began by recalling that the first meeting of the Aeronautical Society had been held at the Great Hall of the Society of Arts in June, 1866.

Ever since that day, he continued, until 1935, when larger audiences compelled a change, meetings of the Aeronautical Society had been held at the Society of Arts. The former society was so poor, and its membership so small, that the Society of Arts often provided a room free of charge in those early days, so that those whom the law sometimes threatened to lock up as lunatics, could talk about the mad days of the future when people would fly.

In the lecture theatre of the Society of Arts had spoken the great figures of aeronautical history—Wenham, Stringfellow, Glaisher, Phillips, Maxim, Hargrave, Pilcher and so many others. The Aeronautical Society appreciated greatly the outstanding tribute which the Council of the Royal Society of Arts paid Orville Wright, when, in 1917, it awarded him its highest honour, the Albert Medal.

The Wright brothers, in their reading, paid particular attention to Octave Chanute's book, *Progress in Flying Machines*. A past-president of the American Society of Civil Engineers, he had made many gliding experiments. Wilbur wrote to him asking for advice and help. Chanute responded generously of his knowledge, and by his constant encouragement over the next few years did much to help toward their success. It was interesting to recall that in his reply to Wilbur's letter he referred to many papers of the Aeronautical Society which might prove useful.

In the year 1900 there was no flying experience upon which the brothers could draw. There were tables of pressures on flat plates and on various kinds of curved wings in winds of various speeds, but none reliable. There had been some kite flying, and some gliding. Two of the most experienced and best known gliders, Lilienthal in Germany and Pilcher in England, had been killed a few years before, and many had suffered disaster.

Early Experiments

The two brothers soon became convinced that all previous experimenters had failed to find the vital secret of control. "The problem of equilibrium," said Wilbur Wright, "had been the real stumbling-block in all serious attempts to solve the problem of human flight, and this problem of equilibrium in reality constituted the problem of flight itself."

Their first glider weighed 52 lb, and was a biplane with a total surface of 165 sq ft, with a span of some 18ft. The brothers chose to begin their great adventure on the sea coast at Kitty Hawk, North Carolina, on a lonely flat stretch of sands where they were not likely to be disturbed and where they could get the winds they wanted for experimenting. "In speculating on possible methods of constructing a flying machine to carry a man, we hit on the idea of providing a structure consisting of superposed surfaces rigidly trussed along their front and rear margins," said Wilbur Wright, "but not trussed from front to rear."

This solution might seem now surprisingly simple, but it was a fundamental discovery in control. The Wrights by their construction could warp each wing tip to give lateral control, as well as move the whole upper wing forward to give fore and aft control. That step alone put the two men in a class by themselves and enabled them to solve, in such a short time, the problem which leading scientists and engineers of the world had for centuries failed to do.

From practical considerations the brothers found that fore-and-aft control could be better obtained by using a small movable horizontal surface in front of the mainplanes. This, with the warping of the wing tips, provided all the necessary control that was wanted. No tail surface, either vertical or horizontal, was provided in this first glider.

The glider was first of all flown as a kite, with one of the brothers lying prone on the centre of the lower wing, to lessen the head resistance. In this way the lift and drag of the glider could be measured in winds of known value. Although the controls were not always as fully effective as they had hoped, the Wrights were satisfied they were on the correct lines. It was during these tests that the brothers began to suspect that many of the published data of Lilienthal and others were not correct. The total time spent in free gliding that first year was only two minutes, all on the last day of the visit to Kitty Hawk.

In one of the most famous aeronautical lectures ever delivered, Wilbur Wright, in September 1901, told the Western Society of Engineers in America of the full-scale measurements he and Orville had carried out at Kitty Hawk, the first of such measurement ever made, and that as a result he and his brother were then beginning to carry out further experiments to determine accurately "the amount and direction of the pressure produced on curved surfaces when acted upon by winds at various angles." In a small wind tunnel, only 16in square, the Wrights tested more than 200 aerofoils at varying angles to the airstream. Many hundreds of readings were taken in only two months. Those two months of aerodynamic research placed the Wrights among the great research workers of the world.

"This was indeed a surprising research programme for the year 1901," said Dr. Lewis, chairman of the National Advisory Committee for Aeronautics in his 1939 Wilbur Wright Memorial Lecture. "So clear was the Wright brothers' appreciation of the basic factors in the problem that they included all but one of the important variables that have since concerned us in wing and aerofoil research."

The fixed rudders nearly led to a bad stalling disaster while Orville was gliding. Although he escaped injury, the machine was damaged and the vertical surfaces were replaced by a single movable surface which was interconnected with the warping mechanism of the wing. Over 700 glides were made in the next two or three weeks, some of them in winds up to 30 m.p.h., with the glider under full control. No glides had ever before been made in such winds, nor had any previous experimenters been able to use a glider of such large surface.

The brothers left Kitty Hawk at the end of October 1902, with the knowledge that they had spent more time in the air in a controllable glider than any other experimenters before them. They had also obtained sufficient full-scale data to confirm their model results and to justify the construction of a power-driven aeroplane.

Hugh Dryden, responsible for all aeronautical research in the United States, declared in his Wilbur Wright Memorial Lecture for 1949: "Wilbur and Orville Wright achieved success as a result of keen intelligent effort and hard work, and not by some chance inspiration. They devised new instrument of research; they conducted extensive experimental programmes in wind tunnel and flight; they studied problems of aerodynamics, thermodynamics and structural design; they applied the results to the design of a practical aeroplane; and they had the immense satisfaction of successful flight."

Powered, Controlled and Sustained Flight

On December 14th, 1903, the first attempt at a flight was made, with Wilbur as pilot. As the machine left the track on which it ran for the start over the soft sand, he turned the nose up too sharply, lost speed and landed heavily, breaking some of the supports of the front elevator.

On December 17th, 1903, five people stood on the bleak sands to watch the beginning of a new era in history. They were J. T. Daniels, W. S. Dough, and A. D. Etheridge, from the life-saving station: W. C. Brinkley, from nearby Manteo, and the inevitable boy, Johnny Moore. With Wilbur at one tip to keep the machine on a level keel as it ran down the track, and Orville lying prone on the lower wing at the controls, the machine rose slowly, erratically, flew for twelve seconds and landed about 100ft from the end of the track. An hour later Wilbur made the second flight of eleven seconds and covered a distance of 175ft. The third flight by Orville covered practically the same distance in 15 seconds and at midday Wilbur made the fourth and final flight, which lasted 59 seconds and covered a measured distance of 852ft.

That afternoon Orville Wright telegraphed to his father in Dayton, "Success four flights Thursday morning all against 21-mile wind started from level with engine power alone average speed through the air 31 miles longest 59 seconds inform press home Christmas." The telegraph operator told a local news reporter who wrote a garbled and untrue account of what had happened. Only three American papers troubled to print anything the following morning, and the *Dayton Journal* refused to print anything on the score that any flight under a minute wasn't news! The greatest news in the world passed the world by.

More interest, indeed, was shown in Great Britain and France than in America. The *Journal of the Aeronautical Society* had

(*Concluded on page* 835)

CANADA IN EUROPE

The Dominion's Minister of Defence Tours R.C.A.F. Stations

"Flight" photograph

The Minister takes morning coffee with his P.A. in the Canadair North Star while flying to Zweibrücken.

AS briefly reported last week, the Canadian Minister of Defence, Mr. Brooke Claxton, recently completed a tour of inspection of R.C.A.F. and Canadian Army bases in Britain and on the Continent. A representative of *Flight* was invited to accompany him in his Canadair North Star, and the offer was gladly accepted. Bad weather persistently dogged the tour, but the major portion of Mr. Claxton's programme was completed.

Leaving London by car early on December 7th, the Minister had as his first duty the laying of a wreath on the Stone of Remembrance in the cloisters of the Runnymede Memorial. This ceremony performed, he drove to London Airport and emplaned in the Canadair North Star which had brought him and his party across the Atlantic *via* Greenland and Iceland.

The intention had been to proceed direct to the R.C.A.F. base at Langar, Notts, and from there to visit No. 1 Fighter Wing, R.C.A.F. at North Luffenham, Rutland. Fog and industrial haze, however, prevented these calls, so, instead, the party flew direct to Dusseldorf. Here the haze was almost as bad. In other circumstances a landing would have been made at Guterslöh in the British Zone of Germany, but the runways there are under repair and the airfield out of use.

From Dusseldorf a two-hour car journey was made to Soest, where the 1st Canadian Infantry Brigade Group, commanded by Brigadier W. A. B. Anderson, is now stationed in one of the new semi-permanent camps built by German contractors. The Brigade has only recently moved in from Hanover. On arrival Mr. Claxton was received by a guard of honour drawn from the Royal Canadian Regiment, some 80 per cent of whom are qualified paratroops who have served in Korea. He spent the remainder of that day and the whole of the next making a very thorough tour of the establishments and opening two clubs. These latter, by the way, are on the banks of the Möhnesee, very close to the famous Möhne Dam which Guy Gibson and his gallant band breached in May 1943.

While Mr. Claxton visited the army camps at Werl, we seized the opportunity to see the dam—and were fortunate enough to be given a first-hand account of the attack by Frau Nölle, the landlady of a guest-house just below the great structure.

The alarm, she recalled, was sounded just before midnight and the first thing that impressed her was the exceptional lowness of the attacking aircraft. The family went down to the cellar and Herr Nölle looked out to see whether it was an incendiary attack, but quickly came back. Amid the din of anti-aircraft fire and the noise of the Lancasters nobody heard any of the special mines explode.

In a matter of a few minutes the water burst into the cellar, which the family hastily evacuated in order to take refuge in the loft. While they were there half the house was washed away, but none lost their lives. They were rescued by firemen at 5 a.m.

Here are some German figures of the damage done and of the rebuilding, which has been executed so well that there are now no signs of any damage: Forty kilometres downstream from the dam the farmers at Schwerte were warned at 3 a.m. to expect an 18ft wave at 4 a.m. One lump of concrete weighing over 60 tons, from the main structure of the dam, was moved 1,400 yards by the rush of water. The Todt organization brought in 1,500 workers and effected a permanent repair in three months. Rebuilding the power house was started in 1949 and just recently completed. There is still some trouble with cracks where the new work joins the old and cement is being poured in under pressure.

On to Zweibrücken

Weather again interfered with the Minister's third day's programme. Good conditions had been forecast for Zweibrücken,

Mr. Brooke Claxton tries his hand at a few bursts from the six 0.5in guns of a No. 413 Squadron Sabre. (Right) Watching a ground-defence demonstration with, on his left, A.V-M. H. L.Campbell, R.C.A.F., and G/C. A. C. Hull, R.C.A.F., who commands No. 3 Fighter Wing.

"Flight" photographs

"Flight" photograph

The Canadian guards of honour provided at stations visited were extremely smart both in dress and drill.

the next stop, where No. 3 Fighter Wing, R.C.A.F. is stationed, but on arrival a G.C.A. landing had to be made. Conditions actually were so bad that the end of the runway was the first object seen after entering the cloud layer from above. Here, again, Mr. Claxton was received with a guard of honour, drawn up opposite the door of the North Star. He was greeted by A.V-M. H. L. Campbell, R.C.A.F., A.O.C. No. 1 Air Division, and by G/C. A. C. Hull, who commands No. 3 Fighter Wing.

The low cloud precluded any flying programme, but the Sabres went to their readiness platforms and the ground defences went into action—with a superfluity of damp-squib pyrotechnics—against an imaginary attack by enemy paratroopers. A car was set on fire to give exercise to the fire brigade, which arrived with sirens going in the best Hollywood tradition.

Next on the programme was a demonstration of gunsight calibration at the butts. After a few sighter shots had been fired, Mr. Brooke Claxton climbed into the Sabre cockpit and fired a number of bursts.

The final demonstration comprised the refuelling and re-arming of two Sabres of No. 413 Squadron. Very keenly performed, this operation was completed in 6¼ minutes.

Afterwards, in the camp theatre, the Wing assembled to be addressed by Mr. Claxton. He remarked upon the astonishing progress that had been made since his previous visit (last April) and went on to say that he and the Canadian people were determined that their forces abroad were to have "conditions as good as we can make them and nothing second-rate, either as regards aircraft, clothing, food or buildings." The programme, he said, would cost approximately 50 million dollars. Some other figures he gave were: Canada has 20,000 men abroad in seven different countries—1,500 in Britain and 8,000 in Germany. To make service in Europe even more attractive 1,500 married quarters are to be built.

Zweibrücken is also the home of the R.C.A.F. No. 1 Air Division, R.C.A.F. Instrument Rating Flight, about which we intend to publish a separate account in the near future. It was by the kindness and skill of one of the unit's instructors that our representative was able to go to Geilenkirchen in a Canadair T.33 (Nene)—under very QBI conditions—to watch No. 3 Squadron R.A.F. receiving its Queen's Standard.

Baden Söllingen, where No. 4 Fighter Wing, R.C.A.F., is based, was the next station scheduled to be visited but this, also, was completely fog-bound. The Minister accordingly decided to make the journey by car, sending the North Star on to Gros Tenquin to await him and to take him on to Paris for the NATO conference held last week.

THE WORK OF THE WRIGHTS (Continued from page 833)

published in April, 1901, the first paper ever written by Wilbur Wright, and leading members of the Society had kept in regular correspondence with the brothers and Chanute. In April 1904 the *Journal* published an accurate account of these first flights, sent to the President, Major Baden Powell, by Orville Wright himself.

The world had almost forgotten the Wrights when, in 1908, Orville in America and Wilbur in France, began flying again, Orville to satisfy the United States War Department they really had an aeroplane, and Wilbur to satisfy a French syndicate that he could fly. On August 10th, 1908, Wilbur Wright made two short flights at Le Mans, one a complete circle and the other a figure of eight. "The newspapers and the French aviators nearly went wild with excitement," he wrote to his brother. "Bleriot and Delagrange were so excited they could hardly speak, and Kapferer could only gasp and could not speak at all . . . You never saw anything like the complete reversal of position that took place after two or three little flights of less than two minutes each."

Orville Wright in Washington caused just as much excitement. Lt. Col. C. O. Squier, who had been working with the Wrights on behalf of the United States War Department, speaking at the first Wilbur Wright Memorial Lecture in 1913, said:

"The Wright brothers came to the War Department and informed us of what they could do, and they so convinced the authorities that money was found to give them this first contract. The contract promised to pay £5,000 for any heavier-than-air machine capable of carrying two people weighing in the aggregate 350 lb with petrol sufficient for 125 miles at a speed of 36 m.p.h. The issue of the contract was criticized severely, and the War Department was supposed to have lost its head.

"In due course the American machine was delivered to the Government. People heard many rumours about it, but never having seen anyone fly, did not believe in it. On September 19th, 1908, Orville Wright went out early in the morning and flew for 58 minutes: only a few soldiers observed him. The effect was marvellous: it disorganized Washington completely. That afternoon he flew again at half-past four, in the presence of every single man, woman and child who could get to the aerodrome."

Not only Washington, but London, Paris, Berlin and other world capitals were disorganized, for there were too many shrewd politicians who were well aware of the portent in the skies. That year, 1908, was a year of unbelievable excitement, enthusiasm and interest in flying, a year which only comes when the world is suddenly confronted with something entirely outside its previous experience.

In May 1912 came the tragedy of Wilbur Wright's death from pneumonia at the early age of 45. His constitution had been weakened by the worries of constant litigation and business. Three years later Orville Wright sold all his business interests, so that he could carry out that aeronautical research he felt inclined to do, free from all business considerations.

After describing the refusal of the Smithsonian Institute to recognize the Wrights' achievements until the eventual retraction of Langley's claim in 1948, Captain Pritchard concluded: "every aeroplane which is flying today owes to Wilbur and Orville Wright the fundamental discovery of its method of control. The warping of the wing tips in 1900 and the forward horizontal plane have been replaced by the aileron and elevator or other mechanical aerodynamic equivalent as experience has grown.

"These were men whose like may not be seen again for many years."

SETBACK FOR SOUTH AFRICA'S CLUBS

THE South African Department of Defence recently notified the eight flying clubs which have been training pilots for the South African Air Force that it intends to carry out all such training departmentally in future. The announcement is regarded as a serious blow to private flying in the Union, and one from which many clubs may not recover. The news was unexpected; in July last the Union Government was known to be considering the introduction of a civil air guard system. Under this scheme, club flying would have been subsidized in return for participation by aircrew and ground staff in military manœuvres once a month. In the event of an emergency, club members would have been liable to be called out for crop-dusting (e.g., against locust swarms), ambulance or military spotting work. Evidently this project has been shelved.

Since the end of the war, the South African Aero Club has urged the Government to assist private flying in some way, and has pointed out that there remain only 14 out of the previous total of 24 clubs. Two of the clubs affected by the recent decision, those of Johannesburg and Cape Town, had purchased surplus Chipmunks from Rhodesia earlier this year, intending to use them for their S.A.A.F. training work.

It is stated that the last intake of pupil-pilots under the club training scheme will be that scheduled for December. When this course is completed, the South African Air Force will take over the flying training. One advantage of the previous scheme has been the geographical convenience of the clubs, which has reduced the adverse effect of training on civil occupations.

ASPECTS of COMBUSTION

Further Summaries of Papers read at Third AGARD Meeting

LAST week we published summaries of a number of the papers read at the third meeting of the NATO-sponsored Advisory Group for Aeronautical Research and Development (AGARD). This meeting, held recently at Cambridge, was devoted to the work of AGARD's combustion-research panel, and on this and the next page we give summaries of the remaining papers, all of which dealt with various combustion-problems in gas turbines and rocket motors. Four of these papers, as indicated at the ends of the relevant summaries, are in French.

The AGARD secretariat has its offices at Palais de Chaillot, Paris XVIe.

Fundamental Approach to Laminar Flame Propagation, *by Theodore von Kármán and S. S. Penner (Advisory Group for Aeronautical Research and Development, NATO).*—The complete system of equations for a theory of laminar flame equations is presented, taking into account both heat conduction and diffusion, and for the case of an arbitrary number of simultaneous reactions. The eigenvalue problem determining the flame velocity is formulated. Two examples are given in order to show that explicit analytical expressions for the flame velocity can be obtained, and are in good agreement with the results obtained by numerical integration of the equations. In the first example (hydrazine decomposition) one reaction is considered as global reaction. In the second example (ozone decomposition) a hypothesis is introduced for the concentration of the free radial O, which corresponds to the steady-state approximation generally used in classical chemical kinetics. In both cases the measured flame velocities are between the flame velocities computed with no diffusion, and with a coefficient estimated by Professor Hirschfelder from the kinetic theory of gases.

The approximate explicit formulae are obtained without drastic assumptions and by using legitimate approximation methods. The assumption used for the ozone decomposition flame has a bearing on a better understanding of the mechanism of chain reactions in general. The method indicated in the paper gives hope that the more complicated chain reactions such as the combustion of hydrocarbons will also be made accessible to theoretical computation.

Some Experimental Results Relating to Laminar Flame Propagation, *by J. W. Linnett.*—For a complete knowledge of the internal structure of a laminar flame burning in a pre-mixed gas mixture it is necessary to know primarily: (1) the burning velocity; (2) the variation of temperature with distance (x) through the flame; (3) the variation of the partial pressures of all the chemical components with x. At the present time there are fairly sound means of determining (1), and it is beginning to be possible to obtain information about (2); little knowledge of (3) exists.

In the paper, the methods of determining burning velocities are discussed briefly and several methods that have been, or might be, used for investigating the temperature distribution through a flame are described (e.g., use of thermocouples, observation of refractive index changes, etc.). It is pointed out that, because the distribution of molecules among the energy levels may not be in equilibrium, different methods may yield different results. Also, some methods enable the temperature to be determined only if it is assumed that the effect of changes of composition on the observed property is small; this assumption may not always be satisfactory. The difficulties of sampling, and the possible use of mass-spectrographs and absorption spectroscopy are mentioned in connection with (3).

Some Properties of Pulsatory Combustion: the Pulse Jet and the Effect of Doped Fuels, *by J. Bertin (Suresnes Technical Group, Special Research Section).*—The use of appropriate fuels naturally leads to better performance in engines employing pulsatory combustion. The fact that these motors (pulsejets) are open-ended, at least at the downstream end of the chamber, appears to call for high speed of combustion to obtain the maximum pressure-rise. S.N.E.C.M.A. has for some time been studying the effects of suitable fuel additives, but no appreciable improvement has resulted. At the same time, extensive measurements were made of instantaneous pressure and temperature at various points on the engine. Efforts were also made to obtain analyses of gases and usable photographs of combustion flames. One of the conclusions reached—during work on S.N.E.C.M.A. pulsejets—was that the chamber pressure actually obtained was almost equal to that estimated, with infinite speed of combustion. It is the poor filling of the combustion chamber which is chiefly responsible for the discrepancy between actual and calculated performance for a given working frequency, and this factor partly explains the lack of advantages resulting from the use of doped fuels. But such fuels are not to be discounted because experiments have so far been made only on pulse motors of low frequency (50-100 pulses per second) and poor aspiration qualities.

Future development will show where performance will finally be limited by too slow a rate of combustion; it is likely that later progress will show the need for the use of doped or improved fuels. [*In French.*]

Flame Stabilization by the Use of Barriers, *by M. Barrère and A. Mestre (French National Bureau of Aeronautical Study and Research [O.N.E.R.A.]).*—The theoretical and practical study of flame-stabilization by barriers shows the importance of the problem of flame-holding; this, to some extent, determines burner efficiency. It appears at present that theoretical calculation of the aerothermodynamic flow-characteristics agrees with the results of experiments in such a way that complete combustion of fuel/air mixture can be achieved.

Knowledge of the mechanics of flame-retention is still vague, although important information has been gained on combustion stability as a result of experiments. The characteristics of groups of similar barriers have been systematically determined for different values of the principal parameters in flow conditions (speed, temperature and pressure). The direct characteristics of the flame-holder remain fundamental in the same way as the stability limits, and influence the choice of the flame-holder: it has been shown that the drag is less during burning than when cold.

The design of a flame-stabilizer, conditioned by the measurements required for the evaluation of a combustion system (stability limits, combustion efficiency and burning losses) is connected with the actual length of the reaction zone. The point at which combustion ceases, found at the commencement of static pressure rise, determines precisely the minimum length for the flame-tube. [*In French.*]

Some Results and Traditional Methods of Study of Turbulent Flow, *by Jean-J. Bernard (French National Bureau of Aeronautical Study and Research [O.N.E.R.A.]).*—The large number of theoretical and experimental studies published during the last few years on turbulence shows the interest and the difficulty of the problems concerned. In studying turbulent airflow, many authors have naturally been forced to cover some ground already covered by the aerodynamicists; for this reason, it is considered useful to deal in this paper with the principal methods and results obtained in the aerodynamic study of turbulence.

The most traditional research, directly applied to practice, tries to determine the normal modifications and corrections to be applied to the standard aerodynamic equations in order to allow more or less empirically for supplementary tensions connected with fluctuations of speed. The application of these calculations to the study of certain airflows does not generally imply any considerable mathematical difficulty, and examples are given in the paper—e.g., the determination of flow speed distribution along an internal surface, and the study of the mixing of two parallel flows; such application permits co-ordination with results of experiments and appears amenable to generalization in combustion phenomena. Modern developments in the theory of turbulence (which do, however, require complicated mathematical calculations) precisely define the occurrence, development and dissipation of turbulence in the same way as the inter-relation found between two phenomena observed at two separate points or at two different moments. These studies produce less directly applicable results of which, nevertheless, some have been borne out in practice. [*In French.*]

An Aerothermodynamic Study of Combustion, *by Jean Fabri (French National Bureau of Aeronautical Study and Research [O.N.E.R.A.]).*—The lecture first summarizes the fundamental equations of aerothermodynamics, and goes on to define from the aerodynamic point of view the theory of global reaction and the corresponding speed of reaction. It is thus possible to distinguish between (a) combustion with a slow propagation-rate or deflagration, and (b) detonation waves. For the former, the value of the speed of propagation is deduced from aerothermodynamic equations; the methods employed are more or less exact according to whether a formal representation or a mathematically

exact value is required for the solution. To ascertain the structure of the flame it is necessary to establish the conditions far upstream from the reaction zone, although, in fact, the volumetric distribution of speeds and temperatures bears little relation to them; the volumetric distribution of speeds and temperatures in detonation waves can be more easily established.

Finally, the method for studying uni-dimensional flames is extended to true laminar flames; it is shown particularly that the viscosity of the flow is one of the causes of the holding or "jamming" of the flame in the neighbourhood of the internal surface. [*In French.*]

Combustion in Vitiated Air, *by Brian P. Mullins (Head of Chemical Physics Department, National Gas Turbine Establishment, M.o.S.).*—The burning of fuels in vitiated air (i.e., air containing additional gas which is neither fuel nor oxygen) differs from that which occurs in pure air. Many investigations have been undertaken during the past half-century into the effects of air vitiation (by the addition of various inert diluents or by a pre-combustion stage) upon such combustion phenomena as flame-propagation, inflammability and flame characteristics, and this work is reviewed and discussed. Following a historical introduction, the material is arranged under the following headings: fundamental data on vitiated air; pre-flame processes in vitiated air; combustion phenomena in vitiated air; performance of a combustion chamber in vitiated air; and combustion with recirculation.

Experimental Studies on Turbulent Flames, *by Arch C. Scurlock and John H. Grover (Atlantic Research Corporation).*—Both turbulent diffusion flames and turbulent flames propagating in homogeneous mixtures are considered. For turbulent diffusion flames, typical experimental results are reviewed which establish that mixing, principally by eddy diffusion, controls the burning process. For both confined and unconfined turbulent flames propagating in homogeneous mixtures, the limited experimental results useful for comparison with theory are reviewed.

Phenomena demonstrated are: the magnitude of the increase in flame-velocity resulting from turbulence; increase in flame distortion and in turbulent-flame velocity with distance downstream from the stabilizer; the characteristic structure of the instantaneous flame-front; and, for confined flames, the presence of flame-generated turbulence.

Experimental results are compared with a theory (previously developed by the authors) for the effect of large-scale turbulence; this theory assumes that turbulence only wrinkles the flame-front without changing S_L, and relates S_T/S_L to the dimensionless parameters v'/S_L, $\rho u/\rho b$, and $S_L t/l_2$. Three effects are taken into account in the theory: eddy diffusion, flame propagation, and flame-generated turbulence.

Agreement of theory and experiment is acceptable in some instances, but in others the need for further refinement of the theory is evident. Indicated refinements include provision for effect of flame curvature and of flame front instability (when it exists) on S_T, provision for effect of "flame Reynolds Number" on percentage conversion of available energy to turbulence, and provision for the effect on S_T of non-isotropy of the flame-generated turbulence.

Additional experimental work is necessary to establish the exact nature of these effects, and experimental approaches which should yield useful data are suggested. Consideration of the effect of rate of increase of turbulent flame area in decreasing S_L indicates only a very small reduction even under extreme conditions. The possibility is discussed that at very high, but obtainable, volumetric heat-release rates the combustion process may approach that of homogeneous chemical reaction and that under these conditions chemical reaction rate may become the controlling factor.

Ignition and Combustion in a Laminar Mixing Zone, *by Frank E. Marble and Thomas C. Adamson, Jr. (California Institute of Technology).*—The analytic investigations of laminar combustion processes which are essentially two- or three-dimensional present some mathematical difficulties. There are, however, several examples of two-dimensional flame-propagation involving transverse velocities which are small in comparison with that in the principal direction of flow. Such examples occur in the problem of flame-quenching by a cool surface, flame-stabilization on a heated flat plate, combustion in laminar mixing zones, etc.

In these cases the problem may be simplified by employing what is known in fluid mechanics as the boundary-layer approximation, since it was applied first by Prandtl in his treatment of the viscous flow over a flat plate. Physically it consists in recognizing that, if the transverse velocity is small, the variations of flow properties along the direction of main flow are small in comparison with those in a direction normal to the main flow. Analytic description of the problem is simplified accordingly.

The present analysis considers the ignition and combustion in the laminar mixing zone between two parallel moving gas streams. One stream consists of a cool combustible mixture, the second of hot combustion products. The two streams come into contact at a given point and a laminar mixing process follows in which the velocity distribution is modified by viscosity, the temperature and composition distributions by conduction, diffusion and chemical reaction. The decomposition of the combustible stream is assumed to follow first-order reaction kinetics with temperature dependence according to the Arrhenius law.

For a given initial velocity, composition, and temperature distribution, the questions to be answered are: (1) does the combustible material ignite? (2) how far downstream of the initial contact point does the flame appear and what is the detailed process of development? Since the hot stream is of infinite extent it is found that ignition always takes place at some point of the stream. However, when the temperature of the hot stream drops below a certain value, the distance required for ignition increases so enormously that it essentially does not occur in a physical apparatus of finite dimension. The complete development of the laminar flame front is computed using an approximation similar to the Von Kármán integral technique in boundary-layer theory.

THE PTERODACTYL ADAPTS ITSELF: SHORT'S SHERPA ON TEST

"Flight" photograph

Unlike its prototype in Nature, the Pterodactyl tailless aircraft, originated by Professor G. T. R. Hill, has in a sense survived, though in a much modified form. Underlying principles are discernible in the Short Sherpa "aero-isoclinic" research aircraft, seen here on test near Belfast. It was, perhaps, not generally appreciated until the story was told in "Flight" of November 20th that Professor Hill is, indeed, "father" of the new wing form, though the Sherpa itself is the work of Mr. D. Keith-Lucas, chief designer of Short Brothers and Harland, Ltd.

SPACE PROBE IN FULL SWING

Hot News from A.D. 2053

WE publish below an extract from a 2053 ether-mail edition of "Space Times," evidently a daily paper concerned with interplanetary travel. It was specially flown back into the present during a superlumic (faster than light) proving-flight by the Saturnia spaceliner described.

TODAY (writes *Space Times'* special correspondent) I can reveal that Britain has a 1,000,000-m.p.h. spaceship which will revolutionize interplanetary travel. A prototype has made several dummy runs on the Milky Way route.

Only America's refusal to grant a certificate of spaceworthiness holds up its introduction to regular service.

Rakish

The rakish craft is known as the Saturnia. Its performance astounds the experts. Carrying 1,000 passengers, it will operate a stage-length of 2,200 light-years (with fuel reserve for diversion to satellite).

Tied up

I learn that British Outerspace Airways Corporation has ordered an undisclosed number of Saturnias at a price fixed by the Ministry of Supply and Demand.

Quizzed about the new craft, a Ministry spokesman disclosed: "I can disclose nothing about the Saturnia."

He refused to comment on *Aviation Leak's* preview, published months ago, when British journals were still gagged by security, tied by censorship and bound by the rules of the game.

The Old Firmament

Speaking off the record, Outerspace chairman Lord Lunar told me that he looked forward to receiving the Saturnia: "The Corporation has great plans, great plans, great plans . . ." (he leaned forward to adjust the record). "British spaceships will girdle the universe," he proclaimed. "Fast cosmic-liners will take care of the inter-planet luxury services, while Saturnias circle the stars with high-density tourist travellers."

"Faster, Farther . . ."

Soon all Britain will be talking about the Saturnia. What do the experts say?

Modestly, the manufacturers told me: "The Saturnia will fly faster, farther with a greater load than any other spaceliner . . ."

Added test-pilot Snagge: "Despite the higher cruising speed, she handles well in the orbit. The let-down was all I expected. Everything went according to plan, it says here, and my head is nearly better now . . ."

Goin' Fission

Like most modern space liners, the Saturnia is powered by instinctive-reaction nuclear engines, with auxiliary repulse-jets to boost it through the atmospheric barrier.

Thin Dividing Line

Unique, however, is the navigational system employed by this all-British supercraft—the electro-telepathic autopilot. How does this wonder-system work? By good fortune, I was able to ask its inventor —U.S.-born Dr. Homer G. Blip, of Eccles —whom I encountered today in the waiting-room of my psychiatrist.

"Simple," explains Dr. Blip. "Thought-transmissions from the pilot's subconscious are fed into the delicate control mechanism which automatically steers the ship to the desired destination." He chuckled: "It's simply a question of getting a good fixation."

SOMETHING THE WRIGHTS OVERLOOKED

THAT perspicacious American organization, Flight Safety Foundation Inc., has published an entertaining piece in one of its periodical information sheets appearing at the time of the Wright Jubilee celebrations. The author is Jerome Lederer, F.S.F.'s director:—

THERE OUGHT TO BE A LAW

Every since the first powered flight at Kitty Hawk, 50 years ago, the aviation industry has built up a system of good practices by which the current safety record has been achieved. This applies to the test flying of prototype aircraft as well as to design and operation. It is extraordinary therefore to find that a test flight of a prototype was made without consideration of factors considered essential to safety. The public was not involved in a big way, i.e., no passengers were carried, not many spectators had gathered and of course a person should have the privilege of risking his own welfare. Nevertheless in the light of current knowledge should this test flight have been undertaken?

Here are the facts:

(1) The risk was compounded: the airplane was a prototype; the powerplant was also a new development; propeller controls had never been flight tested.

(2) Ship was on its first flight.

(3) The pilot, though a veteran at flight testing, had never checked out in this category of aircraft. He was familiar with the structural details, with the equipment and had studied wind tunnel results of the ship but had never flown the type. He afterward admitted his "audacity."

(4) The manufacturer of the airplane and of the engine took no steps to interfere with the pilot's procedures, though fully aware of the risks.

(5) There was no attempt at preflight trials such as taxying, ground manœuvres. However, weight and balance had probably been checked.

(6) Air conditioning system was known to be in good order but no attempt had been made to check communications system.

(7) Fire warning system was not checked prior to flight; in fact there is considerable doubt that it was installed.

(8) No fire protection equipment had been installed in the airplane at time of the first test flight attempt.

(9) CAA was not informed.

(10) Field manager provided no fire trucks, no police protection for spectators, no ambulance.

(11) No attempt made to check physical condition of crew.

(12) Airways Traffic Control was not notified; no definite flight plan was filed. Test area not policed for other aircraft.

Although these and many other safeguards required by good practice were not followed, the flight was successful: a tribute to the designer. For those who want to learn more about it, we suggest a trip to Kitty Hawk, North Carolina. December 17 would be an appropriate day.

BELLE OF THE BALL —1910

"JUDGING by the number of inquiries received, it appears that aviation will form the theme for quite a large number of fancy dresses at costume balls and skating rink carnivals during the season. In the accompanying photograph . . . the skirt is decorated with a series of balloons made from old-gold silk covered with white netting, from which hang little golden baskets. Round the bottom of the skirt a number of covers taken from *Flight*, together with various illustrations from the same source, are artistically arranged . . . The birds are swallows, while the model of a dirigible is made in the same way as the balloons. The model aeroplane which forms the head-dress is an actual model which has accomplished several very satisfactory flights."—*from "Flight" of December 10th, 1910.*

ANTI-SUBMARINE

Powered by an Armstrong-Siddeley "Double-Mamba"

FAIREY GANNET

For service in the Royal Navy—Fairey Gannets will operate from Fleet and Light Fleet Carriers. The Gannet is the latest specialised anti-submarine aircraft produced in Britain.

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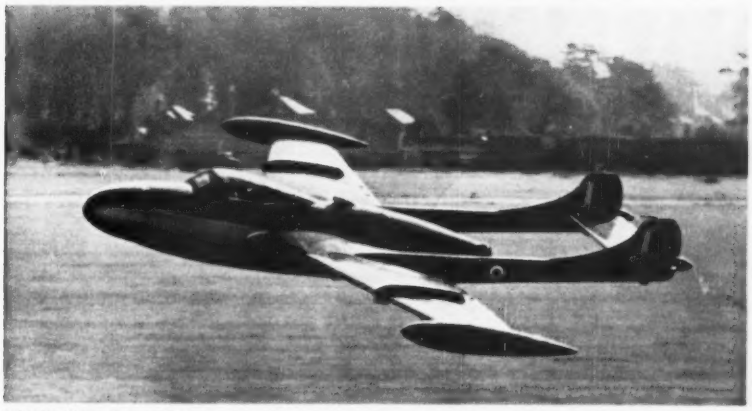
AIRCRAFT INTELLIGENCE



VENOMOUS: This striking tower-to-air view shows a D.H. Venom NF 3 beating up Christchurch after a recent production test. This Venom has a new nose, housing very powerful radar, and other improvements have been made to the ailerons and elevator to provide even better powers of manoeuvre. Two ejection seats are fitted under the clear-view canopy. The NF 3 is stressed for combat with tip and underwing tanks fitted.

Great Britain

Hawker Hunter. Rearward view has been much in the minds of fighter designers of late; the revised canopy of the single-seat Meteors was illustrated recently, and it can now be stated that production Hunters are likewise to have a new pattern of canopy in which the transparency extends right back to the dorsal spine. Even this modification is by no means a perfect answer to the problem, for vision is inevitably slightly distorted when looking through the canopy at an acute angle; furthermore, it is no easy matter for the pilot to turn his head fully round when all equipment is being worn. At least one American fighter is being fitted with a complex system of mirrors with which it is hoped to provide full vision directly astern.

Bristol Britannia. One of the principal contenders for the 1957 era of transports will be a developed Britannia with new power units. Dr. Stanley Hooker, chief engineer of Bristol's engine division, is reported to have an airscrew-driving two-spool unit under development, reminiscent of the Olympus, but about half as large in linear dimensions. At sea level the engine would be throttled to 4,000 h.p., which would thus become an always-available take-off rating maintained up to about 15,000ft. At the latter height the throttle would be fully open and power would drop to about 2,900 h.p. at 36,000ft. Cruising speed should be about 450 m.p.h.

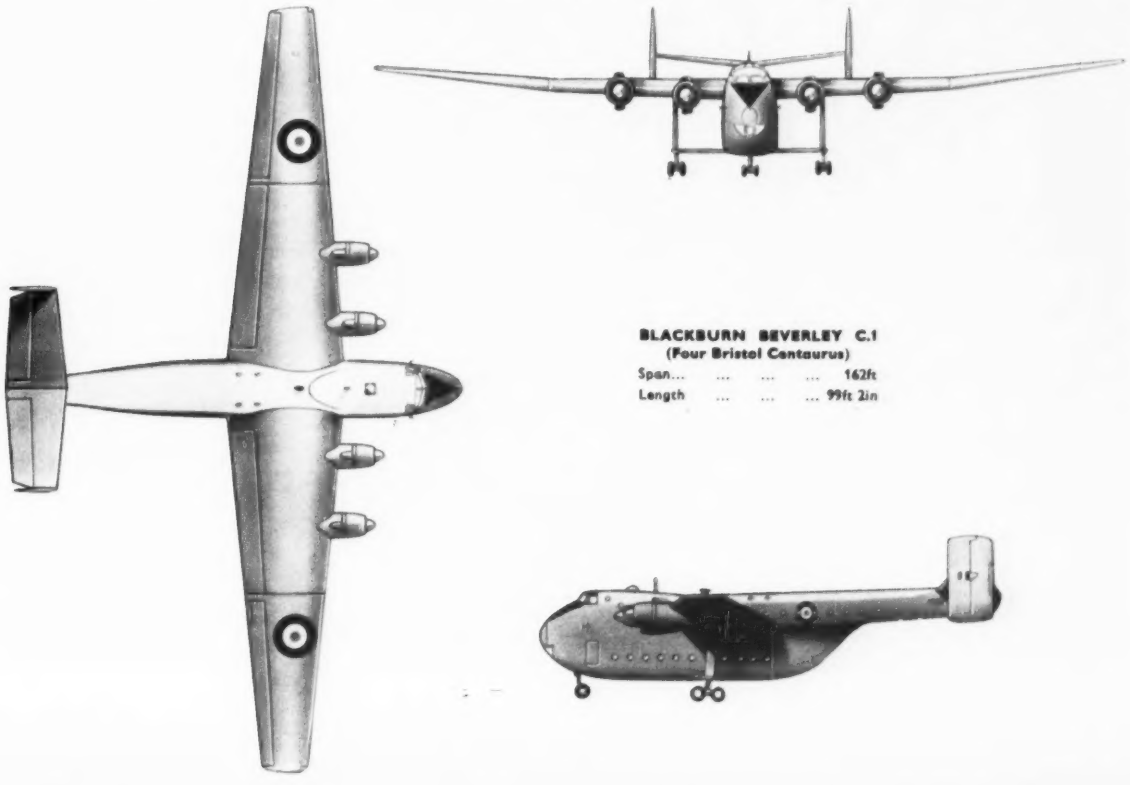
High-speed Projects. In the caption to a photograph of the Short SB.5 variable-sweep aircraft in an American journal are the words: "Note arrangement of ailerons at tip trailing-edges square to air stream. This feature is among favourite British practices on high-speed projects." One can only wait and see.

France

SFECMAS 1402. Great interest has been aroused by the appearance of this lightweight delta-winged intercepter. Designed to be supersonic in level flight, and powered by an Atar turbojet with afterburner, the 1402 is a remarkable design made possible by experience with unpowered prototypes of various configurations (*Flight*, February 6th, 1952, p. 162, and March 20th, p. 354). The prototype 1402 is now carrying out taxying trials at Mélun Villaroche while awaiting final equipment. When the machine is completed it will be transported to Istres for a first flight during the first few weeks of the New Year.

Japan

Mitsubishi Jet Trainer. Yet another American design is to be manufactured in Japan—the Lockheed T-33 trainer, powered normally by an Allison J33 turbojet. Shin Mitsubishi Heavy Industries are completing a mock-up of a slightly modified version, which will go into production next year powered by an unspecified turbojet developed by the Japan Jet Engine Company. (It may be remembered that a Japanese axial turbojet was described in our issue of November 27th last, on p. 699.) The Kawasaki Aircraft Company also have a technical agreement with Lockheed, and licence-production of various Lockheed aircraft including the T-33 will begin next year, largely to fill the needs of the National Safety Force. The latter body are already receiving American and Japanese-built Bell helicopters, Beech Mentors and other aircraft, including fighters.



BLACKBURN BEVERLEY C.1
(Four Bristol Centaurus)

Span	162ft
Length	99ft 2in

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LIGHT LIBRARY

THE

Famous Tragedie

OF

NEVILLE THE DVKE

&

MICHÆL OF LITHGOVVE.

With a Chronycle of ỳ

GREAT ÆRIAL. BATTLE

of

LE BOVRGET

in France.

as it haue sundrye times *failed* to be acted before

HER MAJESTIE

at Banke Side.

Printed by the *Sun Printers* ouer by the *Half-waye Tauern* in the parish of *Watford*
& to be fold at the
HOVSE OF ILIFFE
againſt the *Globe Theatre*
in *Southwarke*

MLCIII.

FRANCE. Before Le Bourget. The Engliſh Camp. Enter Men-at-armes, Yeomen, Peaſants, Camp Followers, and Officers of Publicke Relation.

1ſt Yeoman

THE lillied air of *France* ſhall crack this day
Before the ſhock of Engliſh chiualrie.

2nd Y. E'en now, from skirmiſhing round yonder Mill,
That toppeth ruddilie the *Mount of Martre*,
Our noble ſhockers come.

Enter Neuille the Duke and Michael of Lithgowe

Nev. How now, thou naughtie knaue?
Didst 'guile thy maiden night in *France's* reſtless realm
Mid downy bliſſ; or quaff thy fill
From vine *Burgundian*?

Mich. Alack, the Vine exacteth now its diſmal toll,
My leaden brow doth pound a fearfulle knell,
E'en as the knell shall ſound this day o'er *France*.
But stay. What ghaſtly tendrille of the vine creeps yon?

Nev. 'Tis but a *Vampyre*.

Mich. *Vampyre* in sooth; but of vncommon mien.
I fear 'tis grueſome oortent that our cause this day
Shall meet reverſe.

Nev. Marry, fair coz; full many *Vampyres* creep
O'er *England's* sovreign isle, and little signify.

Mich. Yet creep they still at goodlie *math*
From *A*, e'en vnto *B*.
Now, *French-perverted*, see, this here do creep aback.
Aback forſooth,
With fiery *Goblin-breath* guſhing from nostrils
Set in 'ts glowing tail.
Tis known these *French* do make much sport
By ſubtle variation of our *Engliſh* waye.
But this be necromancie of the blackeſt dye.

Nev. Breathe naught of this, I prithee gentle coz,
To *Woodford's Roland* and his mob *Mancunian*,
Who worſhip at the mighty *Vulcan's* forge;
For 'tis their fond intent to forge
Ahead.
Nor yet diſcloſe to *Stafford's* stalwart crew
The dreadful omen of this ghaſtly scene.
Alas, proud *Victor's* laurels may they yet enwreath
Not vpon creſcent brow,
But on some ruder feature
Of a stern aspect.

Mich. Alack, yon grisly scene do so afright our ſimple yeomanry
That fain they now would fly on *Silver Wing*
To native *Heathrowe* and to *Northern holte*
Repair.
Yet this defection may I yet arreſt with silken *rhetoric*. Behold—
With *Taurus's* stout Line our found'ring hopes
Be now secured.

Addreſſes departing Yeomen

Give ear, my brothers all
Not to *perſuasion's* velvet tongue
But to the clarion that ringeth clear
In every name of this, our brotherhood:
My ſalty ſelf — *Michael of Lithgowe*;
Neuille the Duke; and doubty *Roland's* twain
Of *Beamont* and of *Woodford*.
And sturdy yeomen:
John o' the *Bakehouse*, and stout *Sox* of goodly hose.
Stout *Sox*, who would gyrate a *Bristol*-blazéd path
Into the whirling-pit itſelf,
And lofty *John*, who bids the screeching *Griffons* do his will
From cushioned ease.

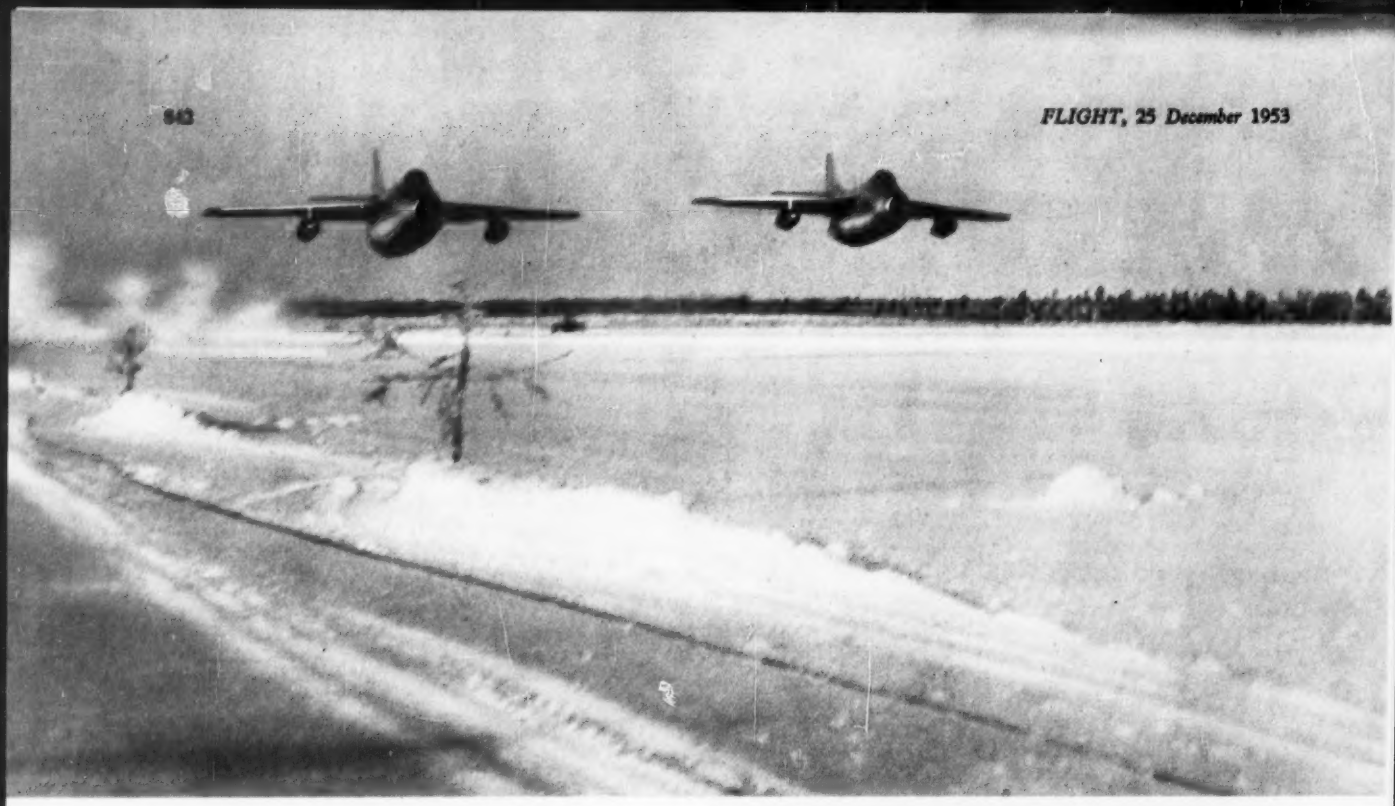
Such is our mettle. Come —
I bid thee page, hande me my *Swift*,
For now shall *Avon's* tide
Bear me aloft to steeps vnfathoméd,
Spurning the waves that ſhock the frozen air,
Cleaving a highway through the puny fence
That men call ſound.
E'en now, o'er ſlound'ring rabble of yon *Frankish* churls,
Bogged in their ſluggish brooks of *Nene* and *Tay*,
I shall aſcend with poſt-combuſtion's blast,
To vpper air.

Nev. In ſooth, fair coz, thou ſimple ſailor-lad,
My ears do play me falſe beneath this helm,
Think'st thou to vault the welkin salmon-leap
In yon sow-bellied coracle?
See, how its bloated carcaſſ now do sprout
Gross elephantine ears and stilty legs,
As do become a miſbegotten hulk
Of *Seafang* born.

Enter Roland of Beamont

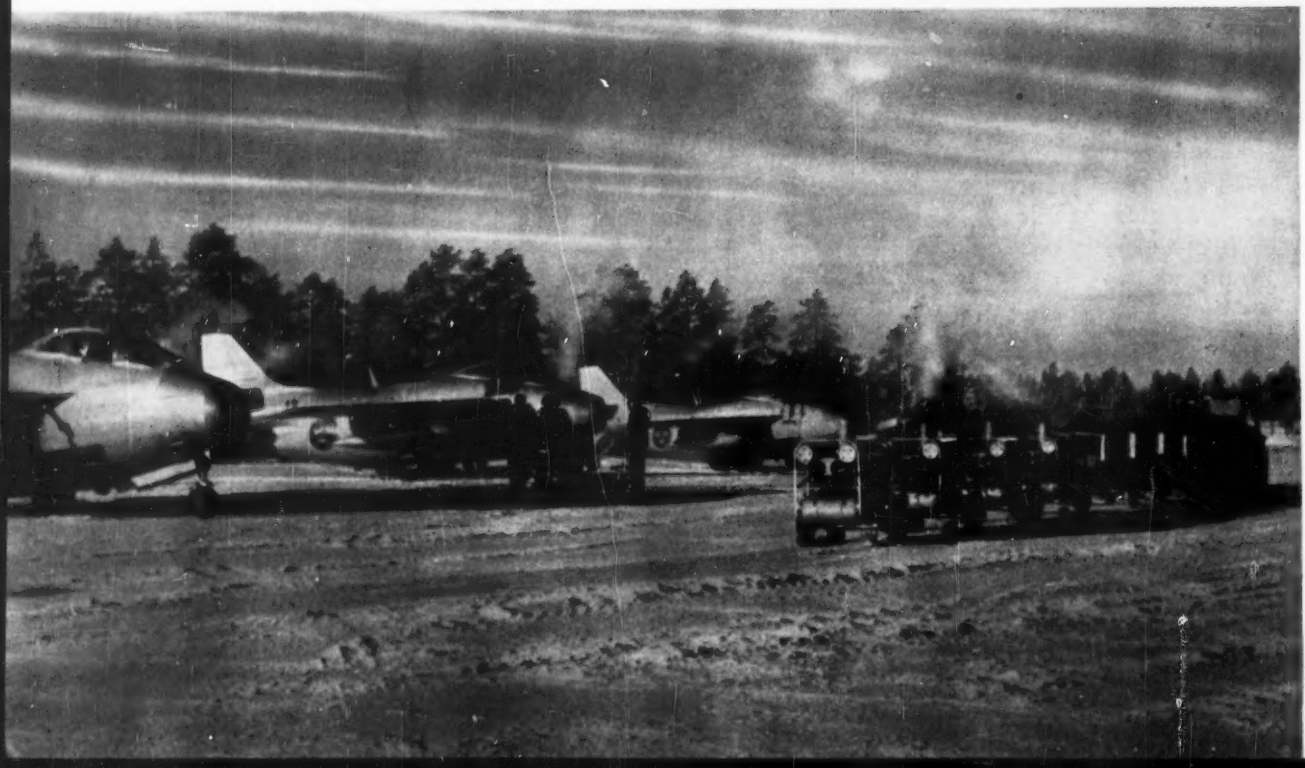
Mich. I bluſh, ſweet *Bea*, that this our bumpkin squire
Of *Dunſfold's* rural tower, should be appriſéd thus
How *Venus's* ripe form aroſe from *Ocean's* bed.

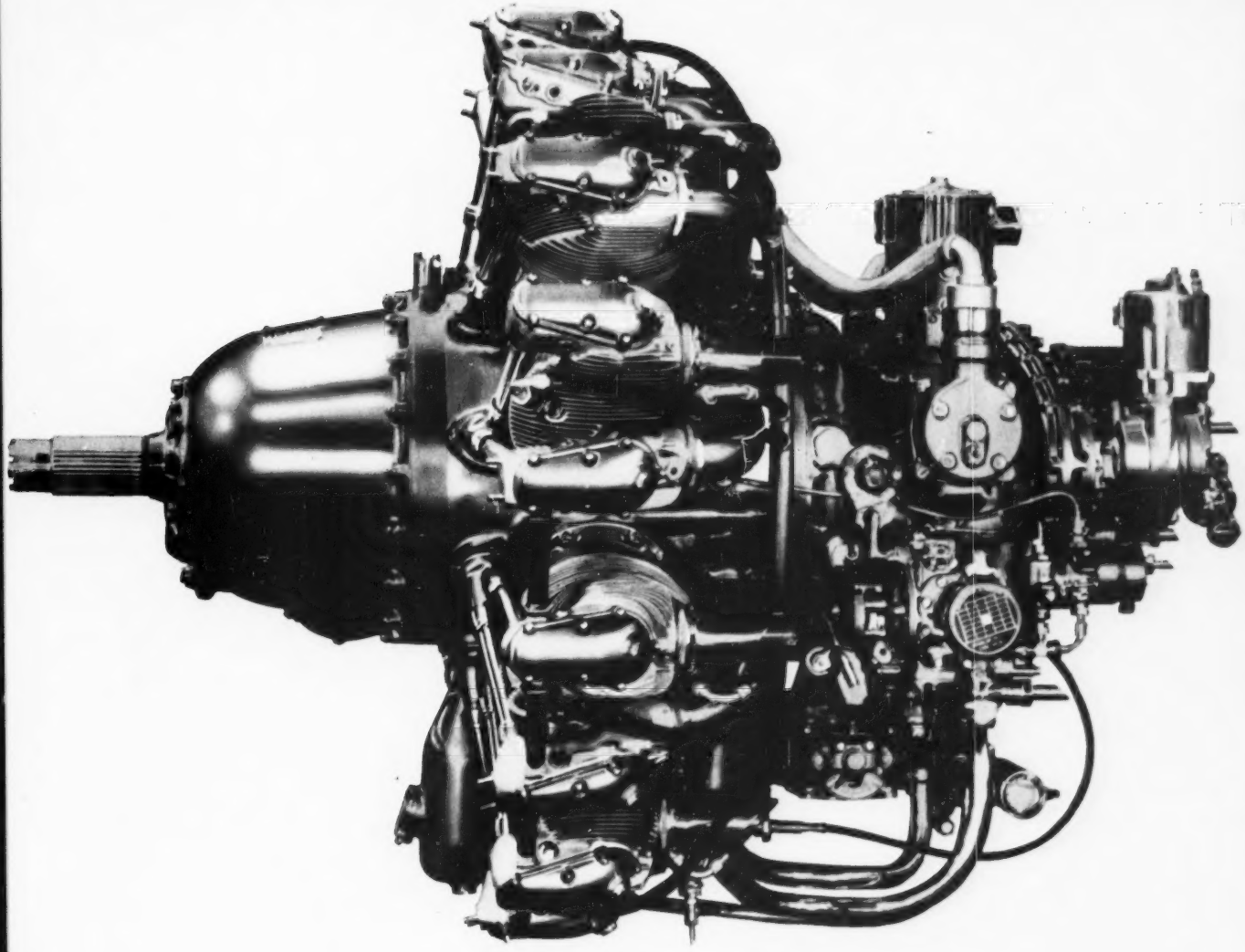
Rol. A plague and murraine on thee both,
And but a single figge for swollen *Swift*
And spindley *Hunter*.
In vinous haze ye prate of shunting *Vampyres*,
Heavenly shockes, and *cake* of nautic' *cheese*.
In sooth, thou shockest me, as this day haue I shocked
The might of *France* with *Engliſh electricitie*.
Fear ye no more the *Trident's* triple prong,
Espadon's flame, or fourth-marked *Mysterie*.
E'en now, the day is ours.
For kingly counſel did I take of royal *Harry*,
Truly to imitate
The action of the *Tiger*.



LONELY GHOSTS

OVER the Swedish wastelands the howl of Ghosts (de Havilland pattern, 5,000 lb thrust) echoes among the pines. Under their hot breath the snow-flurries cloud the icy runway, lingering as the two Saab J29 fighters of the Royal Swedish Air Force (above) proceed on their business. And even if the tracks in the foreground *were* made by the Swedish equivalent of a Naafi van, and not by Santa Claus' sleigh, the picture is still the most Christmassy to arrive in this office in recent unseasonably warm weeks. The small view on the right shows a ground crew, with portable heater, cosseting one of the "flying barrels," and, below, things appear to be warming up for a flight sortie.





ALVIS

LEONIDES

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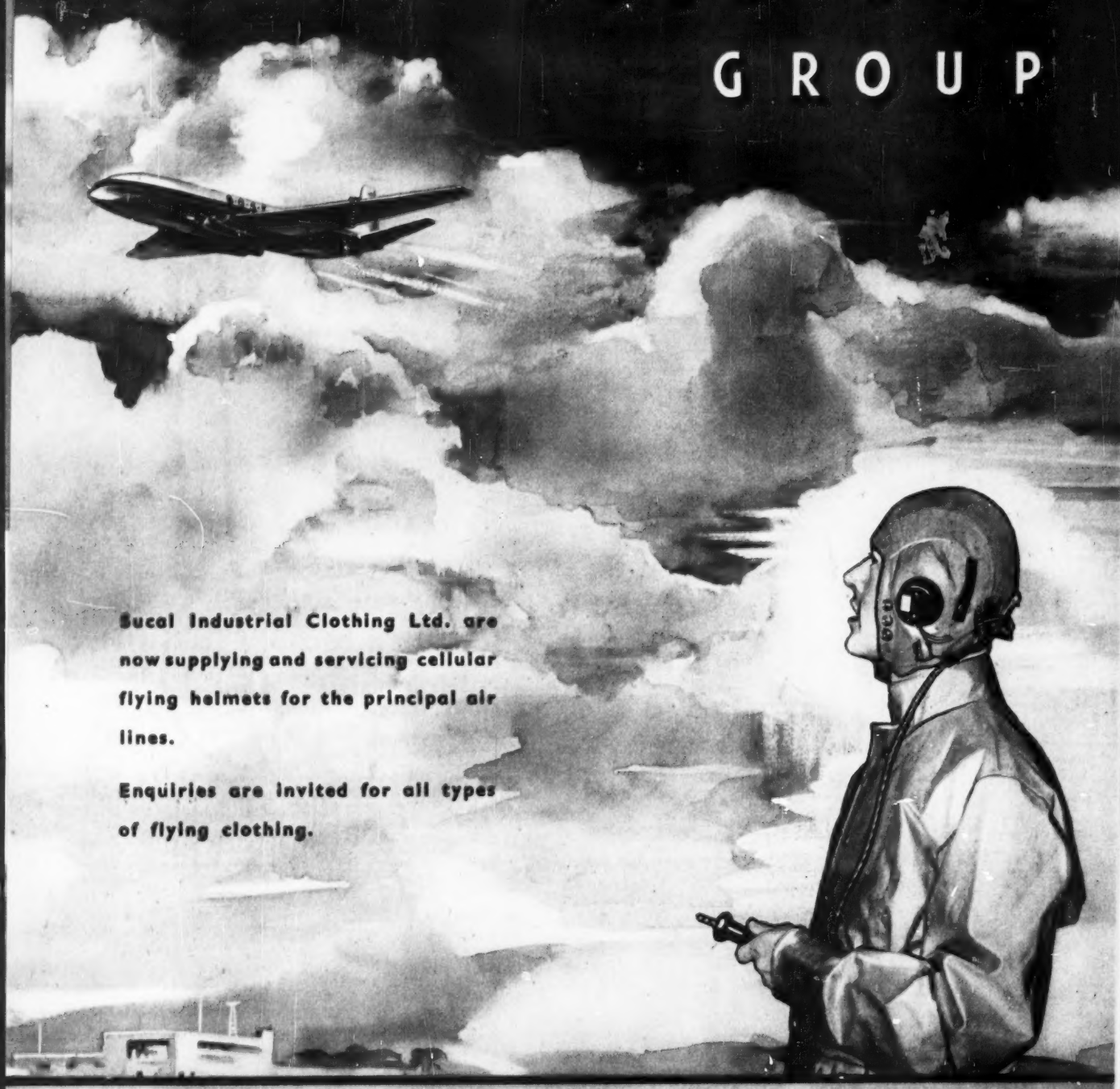

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FLIGHT SIMULATORS

Current Practice Discussed in an R.Ae.S. Lecture

BEFORE the Royal Aeronautical Society in Belfast on December 10th, a paper entitled *Flight Simulators* was presented by Mr. G. B. Ringham and Dr. A. E. Cutler, respectively chief engineer and chief designer of the flight simulator division of Redifon, Ltd. Their lecture is printed here in abridged form.

Presenting the first part of the paper, Mr. Ringham pointed out that the need for safe non-airborne training aids for pilots and aircrew had been created by the hazards of flying, the skill required to pilot aircraft, and the often complicated nature of the flying machine. Attempts to meet the problem had ranged from machines with sawn-off wings pivoted to balance in the breeze to the more complicated navigational training devices developed and brought into use in this country from 1939 onwards.

The speaker went on to trace the historical development of such aids, from those of 1910 to the Link and Curtiss-Wright trainers of 1945 (both of which featured variable control loading).

These trainer units, the lecturer continued, had all been general types intended principally for basic training. They had given good service, but at no time had it been possible to use them to reduce actual flying time. Instruction, particularly on instrument approaches, had been a valuable adjunct to actual flying, but the great dissimilarity in appearance and behaviour between flying trainers and actual aircraft had restricted the trainers' use for other purposes. There was, therefore, a need for a device which could hope to reduce substantially the flying time necessary for conversion and instrument training. Such a device must be an exact replica of the aircraft, and so similar in all aspects of performance that the student-pilot could believe that he was in the actual aircraft.

In its present form, the flight simulator was a computing instrument working on well known electro-mechanical and electronic principles, in which normal and emergency flight conditions were fed in, to pose problems for which the trainees must find the correct answers in their handling technique. If they failed, they could be shown their faults and the cure while still remaining in safe contact with the ground and involving no aircraft flying hours. The aim was to reduce to the minimum the process of flight familiarization with its attendant potential hazards and high cost, while the ability to confront the trainee crew with abnormal contingencies prepared them for any possible emergency.

During any expansion programme on a new type of aircraft there was a powerful case for the development of such ground training equipment in parallel with the prototype aircraft, in order to reduce the cost of initial training. In the Services, where there was a continuous turn-over of personnel, the simulator could be used for conversion training throughout the whole of the life of the aircraft, and so had even greater economic potentialities.

All the conditions found in flight could be found in the simulator, with the exception of the physical effect of accelerations. This was not in practice a disadvantage.

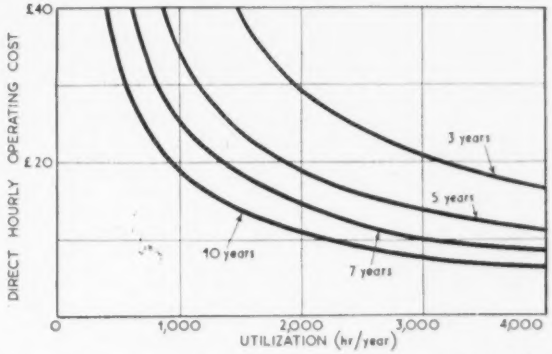
Turning to the economics of flight simulators, Mr. Ringham emphasized that the great complexity of the modern aircraft made it not only expensive to buy, but also costly to fly and maintain. Most operators could not afford to keep aircraft permanently out of service for training purposes, and the savings possible by the use of simulators were considerable. Comparative figures for the operation of aircraft and flight simulators were then given by the lecturer (see tables below).

TABLE I: Estimated Hourly Operating Costs, including Depreciation (Four-engined Aircraft)

Direct Operating Cost Item	Comet 3, (£ per a/c flying hour)	Typical Piston-engined Aircraft (£ per a/c flying hour)
Obsolescence	44.4	33.0
Maintenance and overhaul	60.4	59.7
Fuel and oil, landing fees	96.7	55.8
Totals	£201.5	£148.5

TABLE II: Estimated Hourly Operating Costs, including Depreciation, Flight Simulator

	£ per hour
Maintenance and overhaul	1.75
Power and heating	0.45
Radio aids instructor (ground facilities)	0.5
... ... Total	2.7



Hourly operating costs of a flight simulator for various depreciation periods. The assumed first cost is £160,000 (including building, accommodation and installation).

Further emphasis on the economies which could be effected was given by utilization figures for simulators, which ranged normally from 10 to 15 hours per day. After an initial shake-down period, the loss of training time due to unserviceability of the equipment was less than 2 per cent. The saving in training time using simulators varied considerably between different operators. The standard flight simulator training periods for conversion courses were as given in Table 3. The total time allocated was 35 hours compared with the usual figure of about 20 in the actual aircraft. A few hours of aircraft flying were needed to cover those aspects of flight not intended to be fully practised in the simulator, such as "circuits and bumps," and to confirm the knowledge gained by the pilot on the simulator.

TABLE III: Training Periods

Crew Member	Pilot Station	Engineer Station
Captain	15	2.5
1st Officer	15	2.5
Flight engineer (concurrent)	30	5.0

Total simulator time: 35 hours.

The various aspects of the design of a flight simulator were explained next by the co-author, Dr. Cutler. Complete simulation, he said, required an extensive knowledge of the aircraft itself, for in addition to the flight, engine and atmospheric data, it was necessary to have complete circuits for all the electrical services and instruments, and operating details of hydraulics, auto-pilots, undercarriage systems, cabin pressurization and radio facilities.

The form of computing was related to the operational data supplied by the manufacturers, only the basic flight cabin pressurization and radio aid systems being common to all aircraft. Other systems varied so greatly between aircraft that a specific approach governed only by the broad principles of analogue computing technique was necessary for each particular item. Although Link had produced a computing mechanism based on pneumatic principles, all known flight simulators for aircrew training were electrically operated.

For the "carrier," or that quantity used for transmission of information in the computors, the most favoured were A.C. and D.C. voltages, because they could readily be added, amplified and resolved or used to operate instruments and servo devices. For close tolerance computing the output stability of A.C. amplifiers under wide variations of valve and circuit parameters, and their freedom from drift, made the A.C. carrier desirable. A penalty which had to be paid was the comparatively low efficiency of the A.C. induction motor, but this was offset by the low starting friction due to the absence of brush gear.

The mechanical operations which it was necessary to perform on the carrier in the course of computing were addition, subtraction, multiplication, function generation, integration and resolution.

Addition was readily performed either by series addition, or by parallel addition in input networks. Subtraction was normally obtained by reversal of the polarity of one of the voltages.

FLIGHT SIMULATORS . . .

The method of multiplication was largely determined by the method of integration. If the latter was produced electro-mechanically, it was normal to follow suit with position-operated devices for multiplication. The mechanical process involved was used to move the brushes on potentiometers fed with one of the voltages, the brush position being controlled by the other voltage or its integral to give a product. These electro-mechanical devices were frequently called "computing servos," and formed without doubt the easiest and most accurate of the methods available, although rather expensive.

Good accuracy was possible by application of pulse technique, and this could be considered as a possible solution if a non-mechanical integrator of high stability were available.

In the case of function generation, referring again to the electro-mechanical method, it was clear that any method of changing the law of a potentiometer, such as contouring, shunting or tapping, was possible as a general solution.

The normal integrator in A.C. electro-mechanical computors was an amplifier and motor-generator combination normally called a velodyne. This was a device so arranged that the difference between the generator-produced rate voltage and the driving voltage was used as the input of the high-gain amplifier driving the motor. The best-known non-mechanical integrator was the Miller-type electronic integrator, in which the charging of a condenser through a high resistance, itself a form of integration, was modified by an associated amplifier effectively to multiply the capacity of the condenser by the gain of the amplifier. The leakage across ordinary condensers through the dielectric caused drift which, at large values of the integral of the input variable, could be very serious. For long-term accuracy and stability, drift compensators or special polythene dielectric condensers must be used. A further disadvantage of the electronic integrator was that it automatically reverted to zero when the power was removed, making it impossible to "store" a situation. It was, however, very cheap and quite satisfactory for high-speed operation.

The contoured potentiometer card could readily be employed to generate normal trigonometrical functions of a variable, but special techniques were necessary for the solution of equations involving inverse trigonometrical functions.

It was evident from these considerations of the mathematical processes that greater accuracy and stability could be obtained by using A.C. techniques than was possible by D.C., although D.C. methods were useful in general trainers and the lower-accuracy flight duplicators.

For the simulation of the flight of an aircraft, the aircraft designers must supply to the simulator manufacturer the values of all the stability coefficients and their variation with Mach number and changes in aircraft geometry as produced, for example, by flaps, undercarriage and dive brakes. For airscrew-driven aircraft, there were also effects due to induced airflow over the wings and tail.

The supply of complete and accurate data was a fundamental requirement of flight simulators. The delivery of the simulator was required several months ahead of the production aircraft, in the case of a new type, because it was during the conversion programme that the greatest economies were made. The aerodynamic data must therefore be estimated before the flight of the first production aircraft and confirmed before delivery of the aircraft. Equations for the forward force, side force, lift, rolling moment, pitching moment and yawing moment, which had to be evaluated by the computor, were then given by the lecturer. In these equations, he said, were embodied the whole stability of the aircraft, and the formation of the constituent terms from graphical data comprised the major part of the flight computing.

The lecturer went on to describe the approximations to the full equations which could legitimately be made, bearing in mind the required standard of accuracy. He then showed how the individual terms were interpreted and presented to the computing mechanism in order finally to simulate the various displacements and other effects. Many movements, moments, speeds and angles were inter-related.

The properties of the atmosphere affected the flight and engine performance of a jet aircraft so much that it was necessary to reproduce these properties exactly in the simulator. I.C.A.N. standards defined the temperature of a mean atmosphere in terms of sea level temperature, and all other properties of the atmosphere must be linked to this relationship. In a simulated atmosphere system of good design, the only inputs necessary were ground pressure and temperature, ground altitude and tropopause altitude. The computor evaluated all other effects.

The significance of the ground as a boundary condition of flight was at first a little difficult to realise. It had always served as the platform on which aircraft were stored, manœuvred, accelerated and braked, given flying speed and finally lifted into flying attitude. It had performed these functions in such an unobtrusive manner that, except when things went wrong, its characteristics were seldom noticed.

The ground, however, had a profound effect upon the manœuvrability of an aircraft at zero altitude, whether flying or on the ground. Apart from its action in producing extra lift and nose-up pitching, it also prevented descent and nose-down attitudes, and made available additional braking, lifting and steering facilities. The computor must therefore be arranged so that when the height of the aircraft above the ground was zero, the appropriate effects were introduced.

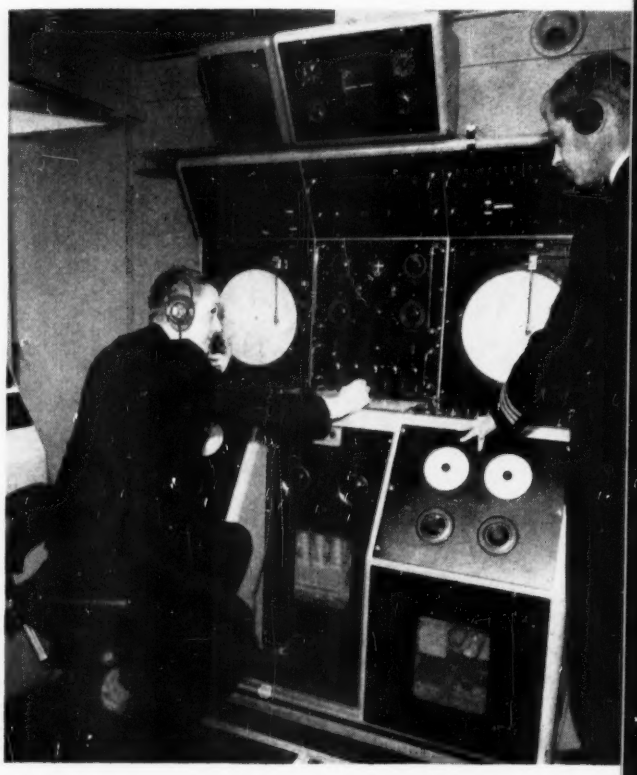
While the basic aerobatic and aerodynamic equations were similar for all types of aircraft, this was not true in the case of engines, of which there existed many types. The pure jet was the simplest power plant to simulate, because it was almost entirely thermodynamic in operation. A quantity of fuel determined by the throttle and the atmospheric pressure was fed to a device which, without any further control, rotated at a stable speed, with all other parameters, such as jet-pipe temperature, thrust and so on, uniquely determined.

The jet engine had substantially constant efficiency over a wide range of r.p.m. There was therefore a single matching process to be carried out, associated with the size of jet orifice, except when an afterburner was fitted and fuel economy was effected by throttle control. Internal-combustion engines, on the other hand, had one speed at which they operated most efficiently, and the action of the airscrews had to be so arranged that the engine was loaded variably to maintain this r.p.m. over a wide range of mixture settings and changes in pressure and temperature. It was therefore necessary to associate complicated synchronizing and governing mechanisms with variable-pitch airscrews to produce smooth and efficient synchronous running. All these factors must be built into simulators to produce the correct operation of all controls. The resulting piston-engine computor was much more complicated than the pure jet computor and had many more external controls.

The turboprop engine was by far the most difficult to simulate because it had two almost independent parts, the thermodynamic section and the airscrew section. No such simulator had yet been completed, although two were expected to be delivered during 1954.

Efficient climb- and cruise-control of fuel, particularly for jet aircraft, was the most important problem for present-day operators. For this reason, a flight simulator must compute accurately

The Comet simulator's radio aids unit, described by Dr. Cutler. It is electrically linked with the large area recorder, which traces long-distance simulated flights on a large map.



A modern torture-instrument for pilots, the instructor's console of the Comet simulator can be used to apply some 120 different faults to equipment and instruments.

the aircraft's fuel flow and fuel contents, so that cruise control could be effectively practised. To do this, it was necessary to simulate completely the fuel scheduling system, including the action of boosters, high-pressure fuel pumps, high- and low-pressure cocks, cross-feed and jettison. The fuel system was therefore quite complicated. The process of division of fuel demand between tanks under cross-feed and isolated conditions were normally based on an analogue, in which the flow of electrical current represented the flow of fuel.

Cabin pressurization was another most important consideration. The quantities for which an analogue must be found in the computor were the mass of air and the total heat in the cabin. These were produced by integration of the mass flow and heat influx rate. As both the latter quantities represented flow they were simulated by a current analogue. Full account was taken in the computor of the effects of mass-flow valves, temperature control valves, spill valves, refrigerator valves, safety valves, discharge valves, air temperature and blower temperature rise.

Standard autopilots were fitted and these operated on rate plus datum control from gyros. The simulator computor contained servos, the outputs of which were the necessary rates and positions, and which were used to replace the gyro platform, the remainder of the equipment remaining as fitted in the aircraft.

The basic operation of hydraulic systems was concerned with the flow of hydraulic fluid from pumps to hydraulic services, using reservoirs to cater for extreme loads or to reduce pump wear. The reservoir was essentially an integrator and was considered as such for the purposes of simulation. The operation of the servos was governed by voltage in direct analogy to hydraulic pressure, the hydraulic pipe circuits becoming electrical circuits and the valves being replaced by switches.

It was not customary in British flight simulators to duplicate the radio operator's position, only those aids directly accessible to the pilot and co-pilot being installed. These were H.F. communications, A.D.F. (including A.N. radio range and long-range D.F.), I.L.S. with fan, Z and runway markers, D.M.E./V.O.R., and intercommunication. In the simulation of the directional aids, it was necessary to obtain data on the position of the aircraft and of the transmitter associated with the radio aid, and by resolution to determine the relative bearing and relative range.

Electrical systems were reproduced almost exactly as in the aircraft, with generators represented by potentiometers which were actuated by r.p.m. and similar devices. All currents were representative, but were scaled down, and the current indicating meters were made more sensitive.

Engine noise could be produced either from recordings made in the actual aircraft or, synthetically, by use of electronic circuits.

The present-day flight simulator was an aggregation of the systems described plus a number of others, united with a fuselage or flight deck correct down to the last nut and bolt to produce together an extremely complete simulation. The computors contained about 500 valves and from 80 to 100 servo mechanisms consuming a total of 12 to 15 kW of power from the normal three-phase mains.

In the flight simulator for the Comet 1, a total of 98 instruments of 31 different types were operated by a total of over 200 input controls and switches. In addition, over 70 on/off indicators and lights were operated by the system.

The instructor's equipment consisted of a console from which could be controlled a large number of failures and effects. These included fires in 20 regions of the aircraft, failure of eight supplies by remote operation of circuit breakers, nine flight instrument failures, seven hydraulic failures, six undercarriage faults, and errors to all engine and fuel system instruments. In addition to these, the other systems could be influenced by additional faults, giving a total of about 120 distinct fault conditions. Also provided at the instructor's position were 15 basic data inputs to the computor, including gross weight, ground pressures and c. of g.

The radio aids unit was arranged to give full operation including failures and deficiencies of all radio facilities in civilian use in Europe, each aid being independently adjustable for different transmitter locations.

The speaker concluded by reviewing the present scope of flight simulators. Enormous strides had been made in the field of flight simulators, he said, since their inception only five years ago. In addition to the obvious refinements of technique, their scope was also rapidly increasing. As an example of this, the Comet 1 flight simulator of British design embodied simulation of hydraulics, fuel systems, auto-pilot, cabin pressurization, de-icing, tuning-in facilities for station selection, zero reader, a large-area plotting table and long-range D.F. facilities, not included in previous simulators. New flight simulators would have altimeter systems capable of $\pm$10ft accuracy from zero to 50,000ft, rapidly interchangeable ident selectors for radio aids, improved I.L.S. systems, improved gyro compass systems, exact atmosphere simulation and many other interesting and novel devices.

In the military flight simulators at present under development, provision was made for attachment of many of the standard radio and radar trainers, currently in use with the Services, such as Gee and search radar.

So far, most things for which a requirement existed had been simulated, but this was not so in all cases. Paramount amongst the features for which a satisfactory solution had not yet been found were visual approach, astro-navigation, search radar and realistic g forces. The last-named would probably never be satisfactorily solved as it was contrary to the fixed-base principle on which all modern flight simulators were designed. With the others, the cost of development was the greatest deterrent.

FORTHCOMING EVENTS

Jan. 2. British Interplanetary Society: "Cosmic Radiation Hazards in Space Flight," by Dr. L. R. Shepherd, Ph.D.
Jan. 6. Institute of Metals: Informal discussion, "Lubricants for Non-ferrous Metal Working."
Jan. 7. R.Ae.S. "Young People's" Lecture: "The Fun of Finding Out in Flying," by Sir Leonard Bairstow, C.B.E., F.R.S., Hon.F.R.Ae.S.
Jan. 9. British Interplanetary Society (North-west Branch): "Our First Goal—the Moon," by P. A. Moore, F.R.A.S.
Jan. 12. Institution of Civil Engineers: "Control of Movement at Airports," by Clifford Hayes and E. J. Dickie.
Jan. 15. Institute of Navigation: "Methods of Air and Surface Navigation," by W/C. E. W. Anderson, D. H. Sadler, Lt. Cdr. R. B. Michell, R.N., and G/C. E. Fennessy.
Jan. 16. British Interplanetary Society (Midlands Branch): Brains Trust.
Jan. 16. British Interplanetary Society (Provisional Yorkshire Branch): Short-paper evening and Brains Trust.
Jan. 18. Photogrammetric Society: "New Stereoscopic Plotting Instrument for Aerial Photographs," by Professor E. H. Thompson.
Jan. 21. R.Ae.S. Main Lecture: First Mitchell Memorial Lecture, by J. Smith, C.B.E., F.R.Ae.S. (at Southampton).
Jan. 22. Helicopter Association: Brains Trust.
Jan. 23. British Interplanetary Society (Provisional Western Branch): "Astronautics in the Next 25 Years," by E. Burgess, F.R.A.S.
Jan. 26. R.Ae.S. Section Lecture: "X-Ray Metallography," by Dr. G. L. J. Bailey.
Jan. 25-29. Institute of the Aeronautical Sciences: 22nd Annual Meeting, New York.
Feb. 4. R.Ae.S. Section Lecture: "Air Intake Efficiency," by F. B. Greatrex, B.A., A.F.R.Ae.S.
Feb. 5. Photogrammetric Society: "New Plotting Machine for Air
Feb. 11. R.Ae.S. Main Lecture: "Recent Developments in the Structural Approach to Aeroelastic Problems," by Dr. D. Williams, M.I.Mech.E., F.R.Ae.S.

R.Ae.S. Branch Fixtures (to Jan. 11).—Jan. 4, *Bristol*, "Review of Developments in Aircraft Equipment," by G. H. Dowty. Jan. 6, *Belfast*, joint meeting with Queen's University Film Society; *Luton*, Wilbur Wright Centenary film: *Brough*, "New Developments in Aircraft Production Engineering," by Professor J. V. Connolly; *Chester*, "Guided Weapons," by D. J. Lyons.

Jan. 11, *Birmingham*, joint meeting with Institute of Rubber: *Halton*, "The Propeller Gas Turbine," by A. C. Clinton.

UNIFORMITY

Some Thoughts on the Attire of an R.A.F. Officer—and What Lies Behind It

ICARUS wore feathers; Lunardi wore resplendently formal attire; Lilienthal wore leather leggings; the Wright brothers sometimes wore wool hats; P/O. Prune (1939-45) wore what was laid down in orders but, being Prune, wore it with a difference.

And since Prune? Nothing much to report. R.A.F. uniform below the hat hasn't changed a lot during the last few years. But how did it become what it is? Why is the R.A.F. officer dressed as he is? What immortal hand or eye (to misquote by a hairsbreadth) framed his fearful symmetry?

World War 1 is a convenient jumping-off point from which to answer the question. So there you are in the era of Fokker triplanes and Richthofen, horn gramophones, Chu Chin Chow and whisky at heaven-knows-how-little a nip. Look at yourself in the mirror. The headgear is unmistakably Army—a forage or peaked cap. The breeches are Army too: and the leather leggings they're tucked into. It's harder to find antecedents for the tunic—a wrap-over affair with double-breasted buttoning, unless there's a clue in its nickname (one of two): "the maternity jacket."

But hold hard a minute! You now appear to be in naval uniform by the inimitable Gieves: only your wings stamp you as a flying type. So it would seem that you are in both Services at once. Any Service, that is, rather than a flying Service. And so you are, in a way. Your Army connection goes back to gasbag-bashing with the Balloon Corps (did you know that artillery spotting was done with balloons in the Boer War? Well, it was). Later, there was the Air Battalion. Then the Navy became interested—and in fact, a lot of "military" flying was done by naval types.

Shortly before World War 1 aeroplanes were officially recognized as offensive machines (as indeed many then were, in any sense of the word) of sufficient importance to have a Service to themselves. And so the R.F.C. was formed. And then the R.A.F.—but that's us, isn't it? At any rate, the quick-change-artist part of the Service's sartorial history was over and things settled down into the familiar blue-grey rut. "But," objects the albatross-eyed reader, "you haven't yet explained who designs the uniform—who actually thinks-up the webbing and the gum-boots and the scrambled eggs and all that. I mean, is it Schiaparelli or the Marquis de Sade? Or does it all happen 'through the usual channels'?"

Unfortunately, it is the last answer that is 99 per cent correct. The usual channel in this case is the Equipment Department of Air Ministry. And they send their emissaries to far-flung R.A.F. stations to cull opinions and complaints about design, quality, modifications and so on (the fact that nobody has ever approached *you* for your opinions does not weaken the story in the least; it *could* happen).

Sometimes the Equipment Department think up their own mods. When they do, they submit their ideas, with all the others they have gathered, to High Level. And High Level takes Appropriate Steps. And that's why you have tapes as well as buttons, or buttons as well as bows.

Perhaps we'd better define the Appropriate Steps. They are these: having decided on a change, Equipment Branch makes out a Qualitative Requirement. To save you the trouble of looking it up, "qualitative" means "concerned with, depending on, quality" (any clearer?). This is sent to the Central Clothing Committee—a body that deals with all three Services. Once accepted by the C.C.C. the idea is talked over with Garment Development, Ministry of Supply. Next it goes to P. Staff (Personnel) for comment. Then a mock-up or several mock-ups of the new piece of equipment may be made for field-testing by serving personnel. Air Ministry and the people who are to make the finished article may suggest modifications: and then the job's as good as done.

Now, we've already said that the C.C.C. deals with all three Services. It therefore follows that changes in the uniform or equipment of any one Service can be instigated by any other. And certainly there's still a strong Army influence in what the R.A.F. wears and carries about. For instance, the fore-and-aft cap so long worn in the R.A.F. came from the Army. So does the webbing; and the present-day beret; and the brass buttons;

"Flight" photograph

Non-uniformity: Assorted caps, double-breasted jackets, field boots, slacks—and even a corncob pipe appear in this 1918 group. The fashions were displayed by No. 207 Squadron.

The female of the species: ("to a woman, clothes are a vitally important part of life"). On the left—other rank, World War 1; behind barbed wire—W.R.A.F. officers of 1917.

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UNIFORMITY . . .

and the polish-saving plastic ones. Even the albatross (that *is* the correct name, isn't it?) comes from the Balloon Corps.

For one achievement, however, the R.A.F. can take full credit: the ceremonial helmet. A truly R.A.F. product this, inspired by the furry-eared flying helmet worn by pilots of the First World War. Here, the Albatross-eyed reader conveniently reappears with this question: "You said something about 'the usual channels' and '99 per cent correct.' What about the other one per cent?" Well, we left that odd hundredth for outside designers. Remember the newspaper stories about the then-new W.R.A.F. hats? What happened was that various outside designers were invited to submit designs: Hartnell's design got the commission, and a very nice hat it is. But this sort of thing doesn't happen very often. Although the one per cent isn't important quantitatively, it is qualitatively. To a woman, clothes are a vitally important part of life. A new hat may start a surge of enlistments: the end of the prohibition of silk or nylon stockings might be considered as important in the history of the Service as the end of prohibition in the history of America.

And if the male reader is smiling superciliously at the frailty of woman, let him cast his mind back to World War II and the fashions—masculine fashions—then prevalent. For instance, battledress was "fashionable"; "best blue" wasn't—except, perhaps, with the fighter types, who liked to leave the top button undone and, in general, to affect "a sweet disorder in the dress." Then there was the cap: *le dernier cri*, you will recall, was to remove the stiffener to achieve the desired squashy effect. And so on and so on.

Exactly how, why and when this sort of thing starts is not known; or, rather, it is easy to discern reasons *why*, but not how and when. It's as unreasonable as Oxford bags, or the zoot suit; as the New Look or the Bikini. At any rate, the prominence given these sartorial freaks shows how important clothes are.

As the correspondence columns of newspapers and magazines indicate, Service uniform, as well as civil dress, is very much in the public mind. Sometimes one wonders whether it is as much in the mind of the Serviceman. It should be: an officer in a scruffy uniform—well, never mind. We're not paid to moralize. Put it the other way round: a *well-cut* uniform is a compliment both to the wearer and his Service—a good thing all round; and a perfectly simple thing to come by for the man or woman, Service or civilian, who goes to the right tailor. G.M.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

History Repeating Itself?

I NOTE with interest the remark, in Harry Harper's article "Wilbur Wright as I Remember Him" (*Flight*, December 11th) that the Wright brothers coupled their wing-warping system to the rudder control, then, later, discarded this linkage as unsatisfactory.

The coupled system was (as stated in your article "The Wright Flyer," in the same issue) used on the 1903 biplane; it was some time after this that they discarded the method. In Fred C. Kelly's excellent biography, *The Wright Brothers* (Harrap, London, 1944), it is stated that in all the flights made in 1905 the rudder and wing-warp were independent; then it is added that, several years later, the Wrights once more returned to the system, though with "an arrangement for modifying the relationship [of the two controls] when making turns."

It is fascinating to speculate what lay behind this indecision on such a fundamental matter. From a study of early volumes of *Flight*, 1909-13, it appears that many constructors of early aircraft were similarly unable to decide on the best method. One wonders whether it was the acquisition of aerobatic skill that eventually led to complete independence being adopted—yet today there are signs of (at any rate a partial) return to coupled rudder and aileron control. It would be interesting to have the opinions—though not too technically, I hope—of aerodynamicists on this curious repetition of history.

London, W.1. R. P.

Emblem

IT was gratifying to read, in your issue of December 4th, that an American company has had the courage to incorporate, in the Fairchild M-186, such features as buried engines and a crescent-shaped wing. I sincerely hope, however, that this will not cause any trouble if it comes to the notice of the Committee for Un-American Activities.

Enfield, Middlesex. D. J. SPARROW.

Farmania

CONGRATULATIONS on your "Fifty Years of Powered Flight" issue, but regrets that you could not manage to illustrate either the Farman Longhorn or Shorthorn, upon which types so many of our great ones were schooled.

London, W.1. FARMANIAC.

[The reason was, of course, one of space, for we had illustrated an earlier Farman type of 1910. But here, in all its strutted glory, is the Longhorn.—ED.]

Delayed Drops

I HAVE only lately had an opportunity of reading *Flight* of August 14th, 1953, in which Maj. T. W. Willans wrote a most interesting article, "This Way Out."

Is it not possible to delay, limit, or even prevent, the type of spin experienced by some delayed-drop parachutists by adoption of some forms of "wings" and perhaps also a "tail"? Something of this kind formed the equipment of "birdmen," among whom, if memory serves from pre-war days, was Clem Sohn. Such surfaces are provided by Nature in the so-called flying squirrel, which in fact is a gliding squirrel, fast and very stable.

The answer to height estimation would appear to be a form of proximity-fuse, which, as fitted in shells and bombs, should be small enough for the parachutist to wear, and more accurate than any other method; a visual indication, rather than a detonator to blow open the canopy, is envisaged.

Cambridge. PEDANTICA.

Autumnal Echoes

I DON'T know if any research has ever been made into air turbulence caused by jet engines over distances, but the following experience may be of interest to your readers.

I live approximately three miles away, as the crow (jet?) flies, from the Handley Page airfield near Radlett. A week or two ago the Handley Page Victor was on the ground and the engines were being run on and off at intervals of a few minutes. I noticed that on every occasion dead leaves from a chestnut tree fluttered to the ground. Was this caused by disturbance of the air or by vibration of the ground? The air was foggy and quite still.

St. Albans, Herts. T. WOODWARD.

Turbojet Claims

FROM your engrossing account of the Pratt and Whitney J57 two-spool turbojet (*Flight* November 27th) one can safely conclude that this engine is an excellent achievement. But I am wondering whether some of the claims that I have seen put forward for this engine in the American Press are strictly accurate.

One U.S. journal quotes Pratt and Whitney's general manager as saying that the J57 pioneered the split-compressor technique, which "was later used in England by Bristol." Another frequently reported statement, attributed to the same company, is that the J57 is "the most powerful aircraft power plant in the world, at least in the non-communist world." Can *Flight* comment upon these claims?

Liverpool. D. SMITH.

[We believe that, when the appropriate figures can be published, it will be seen that the Rolls-Royce Avon, Armstrong Siddeley Sapphire and Bristol Olympus have already been *type-tested* at thrusts equal to, or greater than, any yet announced for the J57. Bristols began calculations for the engine now known as the Olympus as long ago as the summer of 1946 (it was a two-spool unit from the start). Initial proposals to the M.o.S. followed in February 1947, by which time actual design was well in hand. Pratt and Whitney, on the other hand, did not begin work on their engine until a year later, in 1948.—Ed.]

CARDINAL POINTS

—in Correcting an Aircraft Compass: Some Practical Hints on Swinging

By S/L. T. W. NEWBERRY

THE aircraft compass has improved greatly since the early days of its use and the present magnetically monitored gyro is capable of providing a heading reference to a very fine degree of accuracy.

It is well known that it is the uncorrected residual deviations which cause most of the varying compass errors and it is, therefore, most important to reduce these as much as possible. The finer the limits to which we correct our compass, the nearer shall we be to having no uncorrected deviations. This is quite apart from the degree of precision to which we read our heading in flight. In any case, projected techniques will use heading information automatically rather than manually and will demand a more critical degree of correction and interpretation.

It will be appreciated that, in order to maintain the high standard reached in the design and manufacture of the compass, accurate correction is not only desirable but really necessary. Let us examine a few ways in which improvement may be made.

Ground Swinging is Better.—It has been found, and this may surprise many readers, that the required accuracy for correcting modern compasses is only to be attained on the ground. This allows of two methods of swinging; the aircraft may be placed on an accurately marked compass base and aligned with the datum markings, or its heading may be compared with the indications of a landing compass on, say, eight points round the full circle. Which method is used will depend on the equipment available and the procedure in use for the type of aircraft.

Compass Bases.—If the markings on the compass base are used as datum lines they must be accurate. This is frequently taken for granted, but it should be made the responsibility of one person, who should have it re-marked when the local variation has changed by 0.5 degree.

When an aircraft is placed on the base for swinging care must be taken to align it accurately. This is usually done by means of plumb-lines or by sighting a line stretched tightly between the wheel hubs. It is important that, in either case, the aircraft axis which is to be aligned with the base markings is projected truly on to the base.

Using the Landing Compass.—This, again, must be used intelligently. It will, normally, have no appreciable error, but care in its use will minimize any potential cause of irregularity in reading.

In the bowl of the compass will be seen a black pointer—the lubber's line. This is frequently ignored and is sometimes aligned with the North point of the card. In fact, it is part of the sighting device. If it is always aligned with the North point, the bowl (to which it is attached) is always in the same position relative to the magnetic meridian and, during the progress of an aircraft swing, sights will be taken across it in several directions round the full circle. By virtue of its construction, the line of sight passes through the projected centre of the verge ring and, hence, through the centre of the bowl.

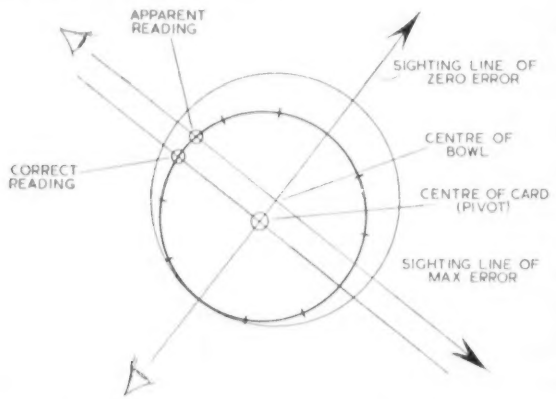


Fig. 1. Reading error due to eccentricity of pivot in bowl.

IMPROVED navigation technique makes it increasingly important that the behaviour of the compass should be of a standard equal to that of other navigation equipment. Maximum accuracy can be achieved only if the uncorrected "hard iron" effect is reduced to a minimum. It is, therefore, very necessary that compass correction be made to as fine a degree as possible and that the residual deviations be accurately applied. Only thus can full advantage be taken of the accuracy inherent in modern instruments. In this article, S/L. Newberry, of the Admiralty Compass Observatory, indicates some points which will enhance the accuracy of an aircraft swing.

Should there be any eccentricity in the position of the pivot relative to the centre of the bowl, it will have an apparent movement (relative to the centre of the bowl) as the sighting device is rotated, in azimuth, on the bowl. This apparent movement will be circular about the centre of the bowl and, as seen in the sighting device, will have a transverse component dependent on the relative positions of bowl centre, pivot and line of sight. Since the pivot must carry the card with it, it will be seen that, as the sighting line moves round in azimuth, the card will have two apparent motions: it will turn in azimuth and it will move from side to side relative to the sighting line. This sideways movement will appear under the sighting prism as a variable reading error. (Fig. 1.) Now, this varying error can be stabilized at a constant value if the relative positions of sighting line and bowl are maintained. This is very simply done by ensuring that the lubber's line is always a feature of the sighting device. Then the bowl and line of sight will always be in the same relative positions and the card error will be constant and may be neutralized by a constant correction. This, also, is shown in Fig. 1.

In Fig. 2 is seen the arrangement of the components of the sighting device when correctly aligned and as viewed through the prism. The most convenient way of aligning is first to rotate the azimuth circle on the bowl until the wire of the foresight appears to run down the centre of the lubber's line, and then to slacken the tripod clamping screw and rotate bowl and circle together to align the foresign wire with both datum marks chosen on the aircraft.

The most critical sight is obtained if the eye is now raised until the image of the card appears to rise to the top of the circular sighting aperture. The lubber's line will disappear and the foresight wire appear to touch the card as shown in Fig. 3. The eye can now focus wire and card together and a reading may be taken to an accuracy of the order of 0.1 deg. If any difficulty is experienced, a few minutes' sighting practice with the compass held in the hand will be found to effect an improvement in the ease of using the instrument.

Levelling.—To obtain accuracy from the landing compass it should be level. The lateral axis of the aircraft should also be level. The importance of this is evident in an aircraft where two datum points are sighted which have a large difference in height, as shown in Fig. 4, where a fin is aligned with a mark on the nose.

The greater the vertical distance between the marks, the greater will be the error in the reading for a given inclination of the lateral axis from the horizontal. In practice, the fact that the fin is not vertical may be less apparent than is shown in the figure.

Random Magnetic Effects on the Datum Compass.—The datum compass may be exposed to random deviation of the Earth's magnetic field, with consequent error, in two ways: (a) the site may be magnetically unsuitable, due to the proximity of ferrous metal or electro-magnetic fields; (b) the operator may bring disturbing fields to the compass through material carried on his person.

The first effect should not be permitted to occur and compasses should be corrected only in previously surveyed areas. A proposed site is easily surveyed by taking simultaneous sights with two datum instruments (such as landing compasses) each of the other between the centre of the area and several points around its perimeter. The readings of each compass should be reciprocals of those of the other. It should be realized that random effects are bad only if they act unevenly in the area so that the datum instrument is affected to a degree different from that of the compass being corrected. This type of effect occurs if the aircraft is standing on reinforced concrete and the datum instrument is set up on the grass. Beware, also, of underground pipes

and cables. To save time spent in surveying areas for a swinging-base, it is always advisable to obtain an airfield plan that shows the run of such items.

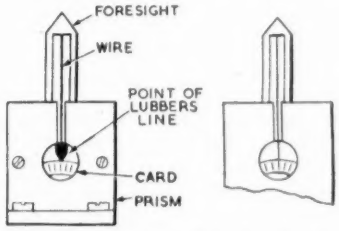
The second case is solved by the operators leaving all magnetic material of appreciable effect well away from the compasses. The main offenders are watches, lighters, fountain-pen clips and penknives. An elusive culprit at A. and A.E.E. was eventually tracked down and found to be a S.D. cap stiffener.

Attention to these points is vital, since an accurate datum is impossible to achieve if distortion of the Earth's field is permitted in the vicinity of either instrument.

Aircraft Datum Markings.—Having taken care that our heading reference datum is accurate, we must now, to maintain this standard, see that we have an accurate means of determining the longitudinal axis of the aircraft and, moreover, one which may be accurately picked up in the sights of the datum instrument. This is best done by sighting two points, as far apart in the horizontal plane as possible, and with as little vertical distance as possible between them. It has now been made a constructor's responsibility that marks for this purpose are provided on the aircraft.

The most straightforward direction from which to sight an aircraft is from astern; the heading is then the reading of the datum instrument. It often happens, however, that the view from this aspect does not include any points which may be said accurately to define the longitudinal axis. In this case, the view from ahead should be inspected. If this view is used, it must be remembered that the heading of the aircraft is the reciprocal of the datum reading.

In some cases it is extremely difficult accurately to judge the longitudinal axis of the aircraft from either fore or aft. The Canberra is an example. In this case, a temporary marking should be made by fixing a strip of masking tape on the canopy over the centre line of the aircraft. This, aligned with the leading edge of the fin, will be found to be quite accurate. It is not advisable to take sights from positions off the longitudinal axis, e.g., by using wing-tips or airscrew blades as sighting marks.



Figs. 2 and 3. Sighting the medium landing compass: (left) aligning foresight and lubber's line; (right) bringing the wire down to the scale.

It is not proposed to go into the mechanics of compass correction here, but one or two points may be worth an airing:—

Sequence of Correction.—It does not matter, from a magnetic point of view, at which stage we remove coefficient A in a compass the magnetic system of which has freedom in azimuth and where its correction does not involve turning the corrector magnets in azimuth; but any compass in which a detecting element is tied in azimuth to the aircraft and to its B and C correctors (such as the C.L. or G.M.4) must have coefficients B and C corrected after any correction for coefficient A. This also applies to direct-landing compasses, such as many American types, which house their corrector magnets in the compass body. The reason for this is that rotation of the detector or compass to correct coefficient A will alter the position of the corrector magnets in azimuth and thus their effect on the magnet system or detector of the compass.

Swinging Procedure.—With the foregoing in mind, the following practice has been found to give accurate results:—

(1) A four-point swing, during which coefficients B and C are corrected. On completion, coefficient A is calculated and, if required, corrected.
(2) If coefficient A has been corrected, a second four-point swing, correction of coefficients B and C and calculation of coefficient A.
(3) An eight-point swing to record the data.

If coefficient A is greater than 2 deg after Stage 2, it should be corrected, and Stage 2 repeated, until coefficient A is below this figure, before continuing with Stage 3. It has been found that correction of coefficient A of less than 2 deg does not sensibly affect the values of coefficients B and C.

The deviations found in swinging (incidentally, it is the aircraft which is swung, and not the compass) should always be referred to the readings of the compass being corrected and not to magnetic headings. The residual deviations should also be so referred when plotting graphs or making out correction cards. If deviations are referred to magnetic headings, the curve, plotted from these results, will suffer a small amount of distortion.

Random Fields.—The effect of all magnetic fields which may influence the compasses must be taken into account by noting the effect of all electrical circuits on the compass indications. These may then be listed and those which are operative for any considerable time in flight may be compensated when in use. These remarks also apply to the movement of controls and, in fact, to anything magnetic which may change its position during flight.

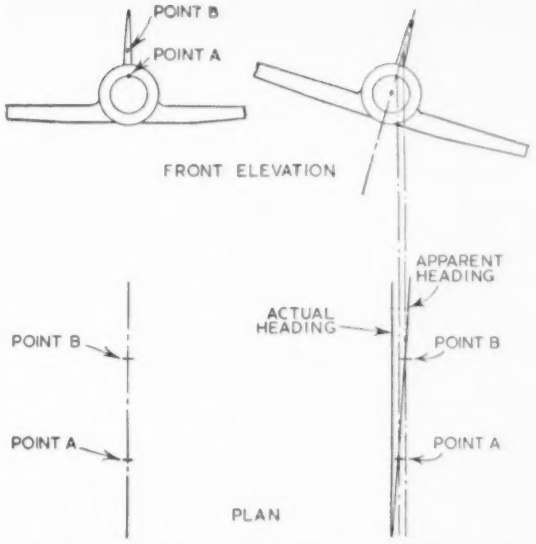


Fig. 4. Relationship of lateral level to heading. This figure shows the front view of an aircraft laterally level (left) and laterally inclined (right). The plan view shows, diagrametically, the error introduced into the apparent heading by lateral tilt.

Correction for Attitude.—This leads us to consider the effect of change of attitude between ground and level-flight conditions. In some aircraft, where the longitudinal axis is steeply inclined when the aircraft is in a tail-down position on the ground, the inclination of the vertical members projects a horizontal component of the vertical hard iron effect which is sufficiently large to produce a deviation of its own on headings of 090 and 270 deg. In level flight the horizontal component disappears and the correction which it has necessitated, in the tail-down attitude, persists as a hard-iron effect—an uncorrected coefficient B. This effect is known as tilt error and, in aircraft where its effect is sufficiently large, is compensated by means of a vertical corrector.

Datum Instruments.—The need for careful treatment of the landing compass will be obvious, since the accuracy of the aircraft compass is limited to that of the datum instrument. To meet the need for increasing accuracy, better datum instruments are being developed. It will, therefore, be appreciated that, with a highly accurate aircraft compass and a datum instrument of even greater accuracy, there must be no lowering of this standard in the use or adjustment of the equipment if the utmost value is to be obtained from its use.

ON ENTERING THE INDUSTRY

PARENTS of boys who have expressed keenness to enter the aircraft industry will find—as will the boys themselves—a great deal of useful advice and guidance in a brochure entitled *Your Future in Aircraft Engineering* and prepared by the Society of British Aircraft Constructors, 32 Savile Row, London, W.1.

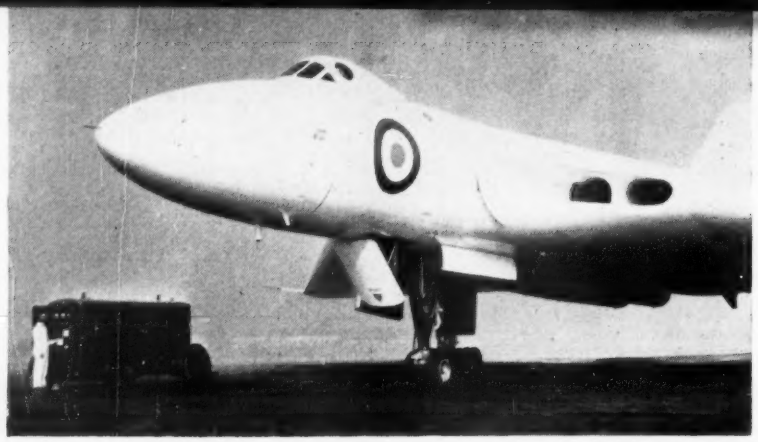
The implications of the various classes of apprenticeship—trade, engineer, student, etc.—are fully explained, there is a note on S.B.A.C. educational grants, and at the back of the book is a list of addresses of aircraft and engine manufacturers, with a map showing the locations of their main factories.

Not the least interesting part of the brochure is a selection of photographs illustrating the many different phases of experience likely to come the way of an apprentice.

BOOKS—ALL ABOUT AVIATION

OVER 600 technical and semi-technical books on aviation and allied subjects, together with items of equipment for navigators, draughtsmen, etc., are listed in a "50th anniversary of powered flight" catalogue lately issued in America. Copies are obtainable, free of charge, on application to Aero Publishers, Inc., 2162 Sunset Boulevard, Los Angeles 26, California.

THE INDUSTRY



TURNING THEM OVER: A Petbow high-duty ground-starter unit ministers to an Avro Vulcan at Woodford. This starter is made by Petbow, Ltd., of Sandwich, Kent.

The Alvis Year

IN the chairman's statement accompanying the Alvis directors' report, presented at the annual general meeting on December 8th, Mr. J. J. Parkes stated that the output of the Leonides engine had steadily increased, and that nine engines of this type were flying in various aircraft at the S.B.A.C. Show. He added that the majority of the helicopters which assisted in the Dutch flood rescues were fitted with Alvis engines.

The company's accounts, presented at the meeting, showed a net profit of £65,849 after taxation.

Controlling Compressor-bleed Air

A RANGE of reducing valves for controlling air tapped for ancillary duties from gas-turbine compressors has been introduced by the Hymatic Engineering Co., Ltd., of Redditch, Worcs. Known as the PS.48 series, these new valves can, it is stated, stabilize inlet pressures of up to 200 lb/sq in at constant adjustable outlet pressures of up to 35 lb/sq in within temperature limits of −40 to +250 deg C.

Pressure control is achieved by balancing air pressure, *via* a piston, against an adjustable spring-load. As the piston is not packed a small leak is unavoidable, but a vent connection is provided to allow the leakage air to be piped away.

Compact and easily installed: the new Hymatic reducing-valve.

A simple but effective means of balance and compensation ensures that the outlet pressure is almost unaffected by variations in inlet pressure. It is claimed that in most cases a fuel-tank pressure can be held to plus or minus 0.25 lb/sq in from the nominal setting for flows up to at least 15 cu ft/min of free air, even taking into account unavoidable pipe-losses between valve and tank. This is achieved by arranging for the reduced pressure at the valve to rise with increasing flow by an amount approximately equal to the pressure-loss in the pipeline to the tank.

A valve from the PS.48 series is suitable for duties where contamination with gas-turbine fuels is likely; the casing, it is stated, is pressure-tight, so that there is no risk of fuel leakage into the surrounding aircraft structure.

Constructed mainly of light alloy, the PS.48 weighs 1.4 lb complete. A valve of this type was used in the Hawker Hunter which recently held the world speed record.

Cable-end Standards

THE following British Standards in the aircraft series have recently been published by the British Standards Institution: SP.101-104: Turnbarrels, tension rods and swaged cable-end connections (UNF threads) for aircraft; SP.105: Swaged cable-end assemblies (UNF threads) for preformed steel wire rope for aircraft (suitable for use with British Standard W.9 wire rope); SP.106: Swaged cable-end assemblies (UNF threads) for preformed non-corrodible steel wire rope for aircraft (suitable for use with British Standard W.11 wire rope).

Nos. SP.101-104 have been prepared to provide a range of aircraft cable-end connections with Unified threads complementary to those with B.A. and B.S.F. threads covered by B.S. SP.33-39. The two new specifications for cable-end assemblies with Unified threads are complementary to SP.53 and SP.54, already published, relating to assemblies incorporating B.A. and B.S.F. threads.

Copies of the new Standards are obtainable from the sales branch of the Institution, British Standards House, 2, Park Street, London, W.1, price 5s each.

Successes by Marconi Apprentices

AT the apprentices' presentation day held recently by Marconi's Wireless Telegraph Co., Ltd., at their Chelmsford works, eighty-one apprentices were presented with monetary awards for outstanding work and on the completion of various courses.

A Marconi craft apprentice can become a student apprentice, and six achieved this distinction this year. Moreover, a student apprentice can by diligent study become a university graduate, and two have been awarded B.Sc. degrees at London University this summer through part-time study.

Speaking at the presentation, Mr. E. R. Lewis (education and training officer) mentioned as an example of the achievements of a particularly successful apprentice the honours gained by student apprentice R. G. Munro, who has been awarded a Technical State Scholarship by study at Mid-Essex Technical College; this will take him to the University of Durham. Last year he won first prize in the junior draughtsmanship class of the Physical Society Exhibition, whose awards are competed for by many important organizations; this year he gained the premier prize, the Sylvanus P. Thomson award for the best entrant in the craftsmanship and draughtsmanship classes.

Encouragement to the apprentices to widen their interests and to realize that leadership required a broad education was given in a speech by Sir Ronald Nesbitt-Hawes, chief of education administration of the English Electric group of companies, of which Marconi's is a part; and Mr. R. E. Burnett, principal of Marconi College, said that the apprentice had help from his parents, foremen and charge hands, technical college, and the education department, but must bear in mind that it was on himself that his ultimate success depended.

Some 800 guests, including parents and fellow-apprentices, watched the presentation of awards by Mrs. F. N. Sutherland, wife of the company's general manager.

IN BRIEF

King Aircraft Corporation, Ltd., have issued a new loose-leaf catalogue of their aircraft components. Bound in a sturdy imitation-leather cover, it contains installation and other data on cowling fasteners, pipe clamps and other fittings.

* * *

Typical applications of Bakelite Laminated for (*a*) aircraft components and (*b*) jigs and tools are illustrated in two leaflets from Bakelite, Ltd., 12-18 Grosvenor Street, London, S.W.1.

* * *

Recent Burgess Micro Switch Developments is the title of an informative, illustrated folder issued by Burgess Products Co., Ltd., Micro Switch Division, Dukes Way, Team Valley, Gateshead 11.

* * *

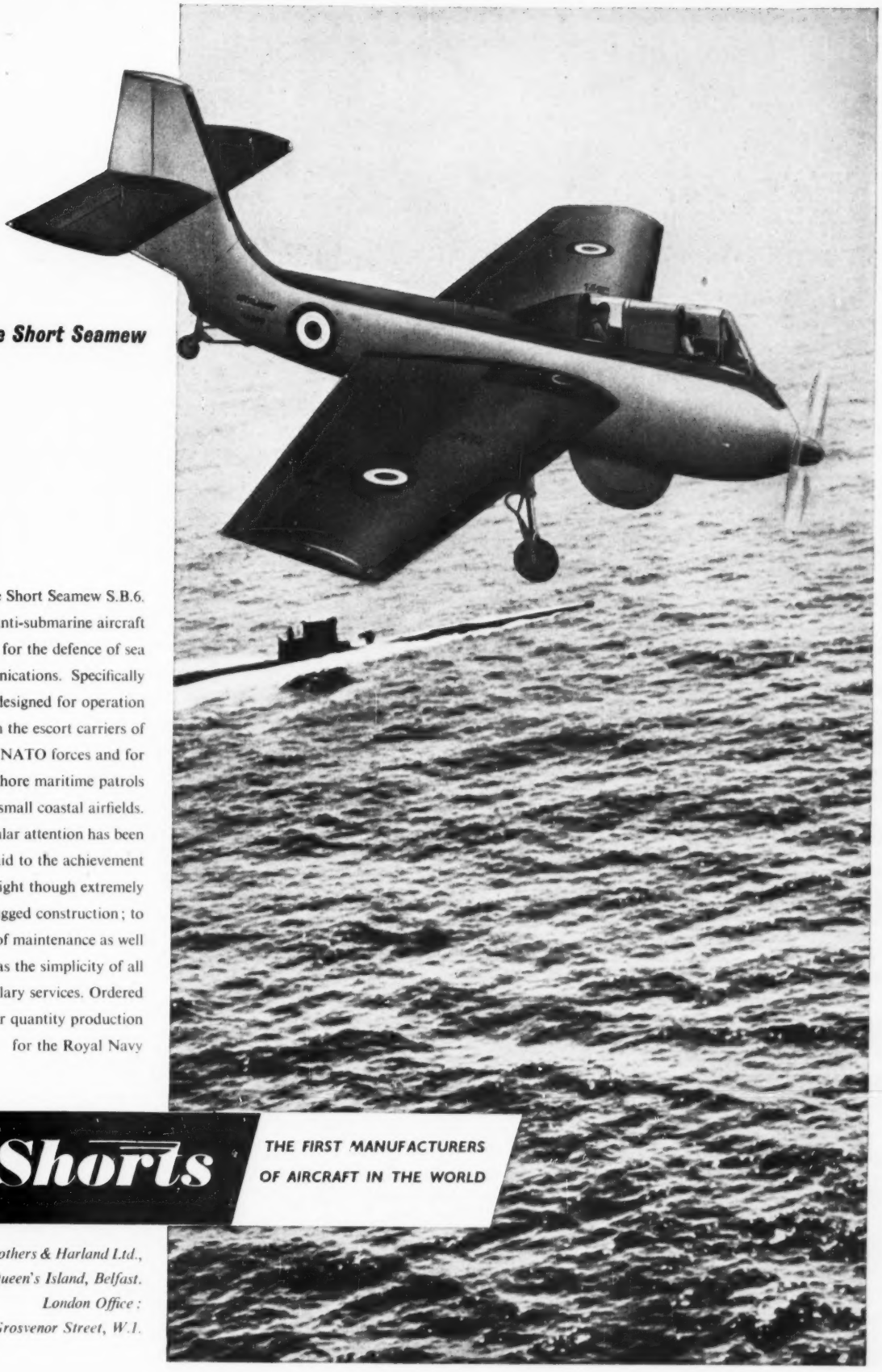
We regret to learn of the death, after a short illness, of Mr. Frank Hartt of J. Stone and Co. (Charlton), Ltd. He had many friends in the industry for some 34 years, particularly in business concerning aluminium and magnesium-alloy castings.

* * *

Mr. John A. Clark and Mr. Michael W. Clark have been appointed directors of the Plessey Co., Ltd. Mr. J. A. Smith, formerly a director, has retired owing to ill-health. It is also announced that Mr. W. F. Cross has been appointed joint secretary with Mr. E. H. Ouston.

* * *

Turner and Newall, Ltd., have acquired a controlling interest in the firm of Glass Fabrics, Ltd., Dungannon, Co. Tyrone, Northern Ireland. The latter firm will continue to manufacture their extensive range of glass-textile products, but will now work in close co-operation with Turner Brothers Asbestos Co., Ltd., of Rochdale, who, from January 1st, will be responsible for the sales of all Glass Fabric products. Turner Brothers Asbestos Co., Ltd., are well known in the aircraft industry for their "Durestos" moulded materials, as used in plastic-wing construction.



The Short Seamew

The Short Seamew S.B.6. light anti-submarine aircraft for the defence of sea communications. Specifically designed for operation from the escort carriers of NATO forces and for inshore maritime patrols from small coastal airfields. Particular attention has been paid to the achievement of a light though extremely rugged construction; to ease of maintenance as well as the simplicity of all ancillary services. Ordered for quantity production for the Royal Navy

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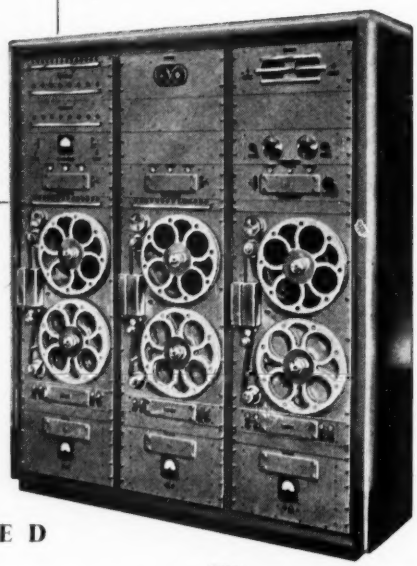

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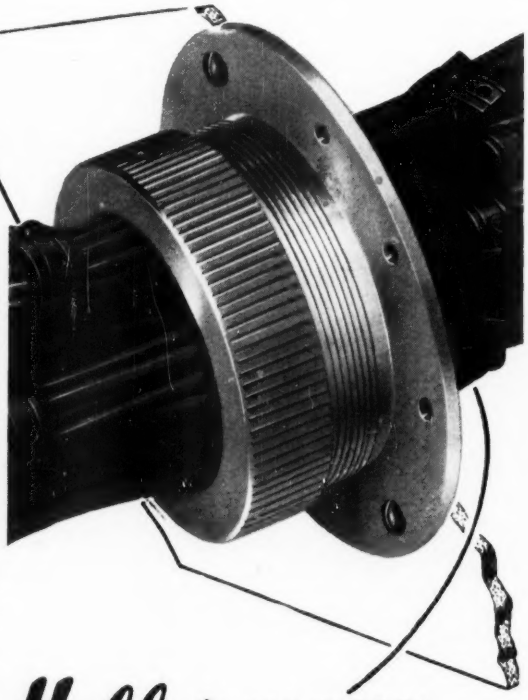

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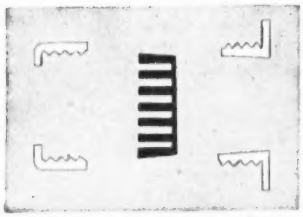

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CIVIL AVIATION

SURVEYOR: This Percival Survey Prince of Hunting Aerosurveys was itself photographed at work over East Africa. Note the magnetometer installation in the tail.

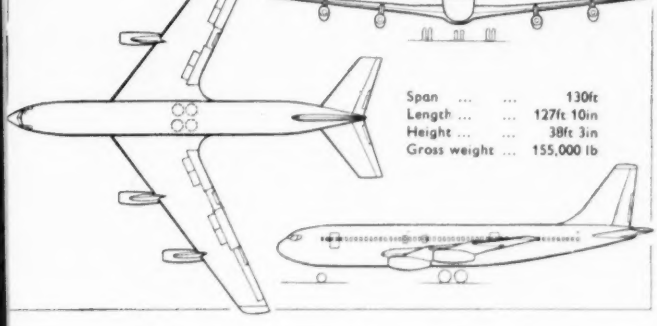
KITTY HAWK TO COMET

ONE of *Flight's* staff set off from our offices in Central London at about 10 a.m. on the morning of December 17th. By 4.30 p.m. that afternoon he was back at his desk after making a flight of about 1,300 miles from London Airport. Such a journey is no longer spectacular in itself, but to us it seemed a fair example of the degree of progress made since the first powered, controlled and sustained flight precisely 50 years earlier.

The occasion, timed to coincide with the Wright anniversary, was the formal inauguration of B.O.A.C.'s upper-air trials over the North Atlantic. These flights, which will be continued in 1954 with a Comet 2, are intended to facilitate intimate study of wind, temperature and cloud conditions at heights of around 40,000ft; to assess the degree of icing which can be expected; and to evolve navigation and control procedures. There will also be take-offs and landings on ice-covered runways at such airports as Gander and Keflavik. The first flight of the series was made by a Comet I—G-ALYS, commanded by Captain T. B. Stoney; his crew consisted of 1st Off. K. Emmott, Nav. Off. G. G. King, Rad. Off. D. H. Kelly, Eng. Off. S. L. Bolton, Steward D. Newfield and Stewardesses D. Furness and M. Osborn. Among the passengers were the manager of the Comet fleet, Capt. M. J. R. Alderson, and two meteorologists—Mr. E. Chambers, met. superintendent of B.O.A.C., and Mr. R. H. Eldridge, an M.T.C.A. forecaster at London Airport.

Unfortunately from the meteorological viewpoint, the flight, which lasted 3¼ hr, was made in uninteresting weather conditions, and no significant winds were encountered, although the Comet reached a height of 40,000ft. After climbing steeply through the thick industrial haze which blanketed London and a broken layer of stratocumulus, the Comet cruised westward in relatively clear and smooth air. Frequent fixes and ten-minute temperature recordings were made during the journey to and from a point within V.H.F. range of weathership "J" at 5242N 2000W—500 miles off the west coast of Eire. Slight "cobblestone" bumps were encountered on both the outward and return legs at cruising height —possibly during the transition from troposphere to stratosphere. Although otherwise uneventful, the trip was an impressive reminder of the Comet's unmatched performance, reassuring smoothness and extreme comfort.

NO CONFIRMATION: Possibly taken from an early brochure prepared by the manufacturer for operators, these drawings and figures accompanied a recent American Aviation *story on the Boeing 707 transport. A cable to Boeing for first-hand information brought us the firm reply that "We've released nothing official on the 707; consequently are not confirming nor denying material . . ."*



SCHIPHOL'S NEW APPROACH LIGHTS

HAVING flown last week from Schipol in poor visibility, the Editor speaks highly of the airport's new approach lighting system (illustrated overleaf). Although fully meeting I.C.A.O. requirements, the system was specially developed for Schiphol by a team of representatives from the Government, the Municipal Electric Works of Amsterdam, K.L.M., the Philips Works and the airport management. Total cost was in the region of £19,000, 60 per cent contributed by the Government and 40 per cent by the municipality. The design has been described as combining features of the British Calvert and American A.L.P.A. systems.

The Schiphol approach lights extend for 3,000ft along the extended centre-line of runway 23, ending 55ft short of the threshold. The six cross-bars are set at 500ft intervals along the centre-line; a total of 410 Philips floodlights, each of 100,000 c.p. maximum intensity, are used. The cross-bar 1,000ft short of the threshold has red lights and the remainder are clear. At the aiming-point, 750ft from the threshold and coinciding with the I.L.S. reference point, there are white-painted rectangles illuminated by green lights.

An important feature of the system is the infinite variation of intensity which can be made to suit visibility conditions. To assist the controller to gauge the intensity required, repeater lights are set 1,500ft from Schiphol's tower; in addition, R/T-equipped observers make periodic reports on the runway visual range. Pilots can have the intensity of the lights adjusted on request, and a Dutch correspondent says that they will eventually be able to control intensity by radio from the cockpit.

Mr. Dallaert, airport manager, estimates that the new lights will reduce by 20 per cent the number of movements cancelled annually (about 500) because of poor visibility.

AIRWORK'S TOWN TERMINAL

A NEW town terminal for air passengers to and from London was opened on December 16th. It is the Brompton Air Station of Airwork, Ltd., and is located opposite the Oratory at 249 Brompton Road, London, S.W. The step to provide the company's own terminal was taken because of the heavy traffic load on the city's three main air-travel centres (those of B.E.A. at Waterloo, B.O.A.C. at Victoria and K.L.M. in Sloane Street).

The new two-floor terminal is actually the nearest of the four to London Airport, Northolt and Blackbushe and is decorated in modern style. The usual passenger-handling facilities are provided and a refreshment bar is included.

TRANSATLANTIC HERMES?

OTHER news of Airwork's activities has come from American sources, which say that the British company proposes to inaugurate twice-weekly freight services between London and New York with Hermes aircraft. These would be replaced later by DC-6As. According to *American Aviation Daily*, Airwork's application to the C.A.B. (British government approval has already been given) mentioned an estimated loss of £42,000 using the Hermes, compared with an annual profit of £230,000 with the DC-6A. An order for the American freighters depends upon award of the C.A.B. permit. Although not officially confirmed in London, the report is believed to be substantially correct.

CIVIL AVIATION . . .

AND NOW THE DC-7B

ADDITIONAL fuel and a higher take-off weight are the main features of a new version of the Douglas DC-7, designated DC-7B, ordered by P.A.W.A. The company's order for seven aircraft brings to 88 the total number of DC-7-type airliners sold. Other purchasers are United, Delta-C & S., Panagra, Eastern, National and American.

PanAm DC-7Bs will carry 6,260 U.S. gallons of fuel compared with 5,526 gallons in the standard version, and the take-off weight will be 2,500 lb heavier than the previously announced maximum of 122,500 lb. With a payload of 52 passengers, mail and freight, they will be able to operate a stage-length of 4,000 miles with a fuel reserve of 1,000 gallons.

Mr. Nat Paschall, Douglas vice-president for commercial sales, describes P.A.W.A.'s aircraft as the first of the DC-7 series built especially for over-ocean operation, adding that it will be capable of flying non-stop from New York to London in just over 10 hours. The DC-7B will have the same power units as the DC-7—four Wright R.3350 compound engines each delivering 3,250 b.h.p. at take-off. Costing over £700,000 each, the new aircraft will be delivered in 1955.

SWISS CAR FERRY

A NEW ferry service between Blackbushe and Zurich will be inaugurated by Silver City Airways on January 2nd. Carrying up to three cars and 20 passengers, Superfreighters will make a weekly round trip on this route during January, February and March. The one-way fare for cars of up to 13ft 6in in length will be £25, and longer cars will cost £35; passenger fares will be £14 17s single and £26 15s return. Aircraft will leave Blackbushe at 8 a.m. on Saturday mornings. taking about 3 hr for the 490-mile flight; return flights will be at 2.30 p.m. on Sundays.

BREVITIES

ON December 8th a DC-6B of Canadian Pacific Airlines, carrying 57 passengers and a crew of eight, made what is claimed to be the longest non-stop commercial passenger flight. With the aid of strong tailwinds, it covered the 4,700 miles from Tokyo to Vancouver in 13 hr 51 min, averaging some 345 m.p.h.

* * *

B.O.A.C. announce that Mr. John Linstead, one of the original Imperial Airways trainees, has been appointed sales planning manager at head office. He is succeeded as manager (Far East) by Mr. R. H. Trench Thompson, and Mr. J. R. Allison, manager at Basra succeeds Mr. Thompson as manager (Pakistan). The new manager at Basra is Mr. A. B. Palmer.

* * *

Six new *Civil Aircraft Inspection Procedures Leaflets* were issued by the A.R.B. on December 1st. The leaflets give guidance on, respectively, testing of pressure cabins; maintenance of landing wheels; methods of crack detection; fire precautions; fire detection equipment; and fire extinguisher equipment.

* * *

At the request of the M.T.C.A. the Air Registration Board is to withdraw approval of life-jackets which are "not simple to operate and which are not capable of supporting an unconscious person for a reasonable period in such an attitude that he will not drown in moderate sea conditions." Types of jacket affected by the decision are mentioned in *Notice to Licensed Aircraft Engineers and to Owners of Civil Aircraft* No. 39, Issue 2.

In Caracas, on December 8th, Dutch and Venezuelan officials began discussions on the subject of a bilateral agreement between their two countries.

* * *

Glamorgan County Planning Committee has granted permission to Swansea Corporation to retain Fairwood Common as a municipal aerodrome for civil use.

* * *

Pan American World Airways have declared a 40 per cent share dividend, the company's highest since the war. A previous dividend of 25 cents per share was paid at the end of July 1953. Stockholders have received payments each year since 1941.

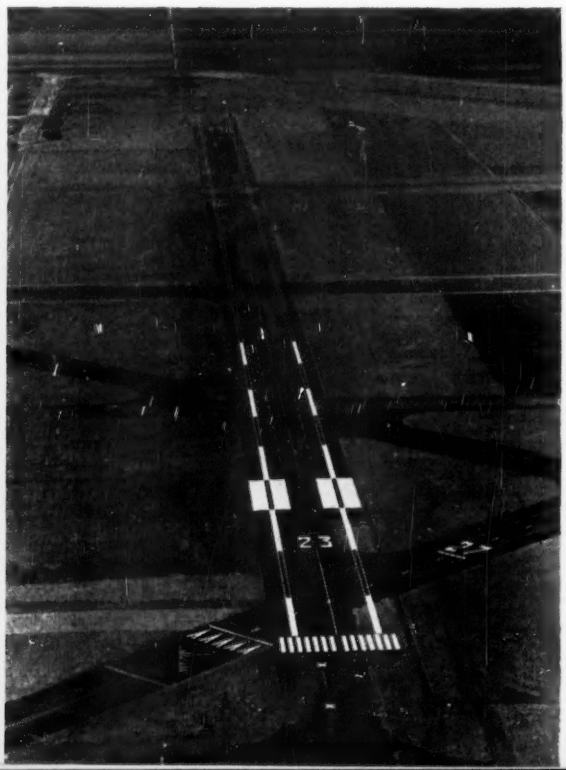
* * *

To meet their current heavy traffic demands, B.O.A.C. are operating 11 extra Comet return services on the London-Singapore route until March, 1954. Services leave London on Thursdays, and depart from Singapore on Saturdays.

* * *

Recent developments of the single-engined Type 171 Sycamore include a pest-control spraying version, equipment for which is being designed and manufactured by Pest Control, Ltd., of Cambridge. The basic vehicle will be the adaptable Sycamore 4, one of which will be used to demonstrate prototype spraying gear to the Air Registration Board. When the Board has approved the equipment, it will be produced by Pest Control and marketed by Bristol's.

AMSTERDAM APPROACH: In accordance with the latest I.C.A.O. standards. Runway 23 at Schiphol has been equipped with cross-bar approach lighting (left) and day marking aids. The cross-bars are spaced at 500ft intervals and are of identical length, whereas the Calvert system at London Airport has cross-bars of converging length. The markings emphasize the threshold, touch-down zone and centre-line of the runway. White, red and green lights are employed; six white pilot-lights, facing the tower, enable the controller to assess and adjust intensity.



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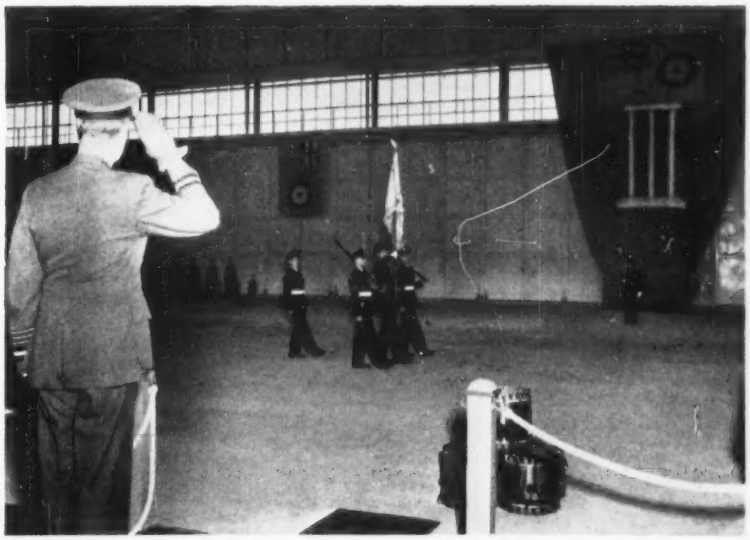
Royal Air Force and Fleet Air Arm News



SLOW MARCH-PAST: No. 3 Squadron's newly presented Queen's Standard passes the saluting base. The Standard bearer was F/O. A. W. A. Wright and comprising the escort were Sgt. D. J. Drake, Sgt. S. Bayliss and Sgt. D. R. Stride.

Stonehenge to Sabres

ALTHOUGH the previous afternoon—when guests should have flown in—had been an I.F.R. period of the very worst kind, the day of the presentation of the Queen's Standard to No. 3 Squadron at Geilenkirchen, Germany, was sunlit, almost spring-like. It was so pleasant that many regretted that the ceremony was to take place in a hangar; but European weather in December is a fickle thing.

To a visitor it was quite obvious that the squadron had gone to exceptional lengths to make this the parade of parades in its long history. The unit is steeped in tradition—the design of its original badge was based on three monoliths of Stonehenge, signifying the squadron's inception at Netheravon, when the Air Battalion of the Royal Engineers became the Royal Flying Corps.

Outside the hangar were three gleaming Sabres in the new R.A.F. camouflage paint; and inside, as a backcloth to the ceremony, was a vast red curtain on which stood out in gold the monolithic squadron number surmounted by the R.A.F. Ensign.

For the reviewing officer, Air Chief Marshal Sir Philip Joubert de la Ferté, this setting must have been a nostalgic one, for he was a lieutenant in No. 3 Squadron when it was first formed.

As seen from the dais the parade order in the hangar showed No. 3 Squadron (S/L. W. J. S. Sutherland) drawn up in front of the backcloth with No. 75 Squadron L.A.A. (S/L. I. A. Mitchell, M.C.) on the left and No. 80 Squadron L.A.A. (S/L. J. F. Oliver) on the right. The last guests to arrive, Air Chief Marshal Sir Basil Embry and Air Marshal Sir Harry Broadhurst—perhaps two of the most colourful personalities in the whole Royal Air Force—took their seats and the setting was complete, awaiting only the arrival of the reviewing officer. Precisely at 12 noon he came, accompanied by A.V-M. R. B. Lees, A.O.C. No. 83 Group, to be received with a general salute.

Parade ceremonial for the presentation of Squadron Standards follows a set pattern from the "uncasing" to the "advance in review order" but the manner of execution differs greatly as between one squadron and another. Remembering that there has been a long period in No. 3 Squadron's history when drill took on a more important aspect than it does today, it is still safe to say that no one who had ever served in this famous unit could have failed to be proud of it on this day. The uncasing was performed with unhurried dignity—the silken beauty of the Standard being displayed to its best advantage as it was gently draped over the piled drums, and showing to advantage the selected eight battle honours: Western Front 1914-1918; Mons, Somme 1918; France and Low Countries 1940; Battle of Britain 1940; Normandy 1944; Arnhem, France and Germany 1944-1945. Perhaps the most impressive moment of all came with the "reception of the Standard." In this the Standard was slow-marched from the dais to the ranks of the squadron while the band played the National Anthem. As it was borne across the hangar a shaft of sunshine spotlit the Standard, attracting all eyes to its bright colours and its immaculate escort.

Sir Philip Joubert de la Ferté began by paying tribute to the late Air Chief Marshal Sir Robert Brooke-Popham, who as the unit's first commanding officer, would in other circumstances have been the reviewing officer on that day. He then went on to remind the squadron of its motto "The Third are First," pointing out that the rest of the R.A.F. would look to them as an example; he hoped they would impart that sense of leadership to the whole of the Service.

The previous day's bad weather prevented the arrival of a number of old members of No. 3, but Brigadier de Soomer of the Belgian Air Force, who was a wartime commanding officer, was there—and very proud, too, of his old unit. He is now A.O.C. No. 69 Group, which is made up of contingents from the Dutch and Belgian air forces.

By a strange coincidence, the presentation took place on the last day of S/L. Sutherland's command. He has now handed over to S/L. R. C. H. Simmons.

HIS OLD SQUADRON: Air Chief Marshal Sir Philip Joubert de la Ferté, K.C.B., C.M.G., D.S.O. inspects No. 3 Squadron. With him are S/L. W. J. S. Sutherland, the Commanding Officer, and G/C. C. W. K. Nicholls, Station Commander at Geilenkirchen.

Glasgow Promotion

GLASGOW University Air Squadron has been accepted as a grade 1 unit and will now have the same standing in the Service as the Air Squadrons of Oxford, Cambridge and London Universities. The squadron's permissible strength is accordingly increased from 60 to 100. Its present strength is 86.

R.C.A.F. Chaplain

A NEW Director of Religious Administration (Protestant) to the R.C.A.F. has been appointed. He is G/C. F. MacLean, 48, a native of Trenton, N.S. He succeeds G/C. R. Frayne, who died suddenly last June. G/C. MacLean was previously Command Chaplain (Protestant) for Training Command, R.C.A.F.

No. 609 Sqn. Appointment

THE Air Ministry announces the appointment of S/L. E. Evans to command No. 609 (West Riding) Squadron, R.Aux.A.F., at Church Fenton. S/L. Evans

SERVICE AVIATION . . .

is a regular officer who first joined the R.A.F. in 1939. He served during the war in the Middle East and after demobilization rejoined the R.A.F. in 1946. He has since held a variety of appointments in Intelligence, at No. 13 School of Recruit Training, and as S.Ad.O. at Church Fenton. He has recently completed courses at No. 226 O.C.U. and at the Day Fighter Leader School at West Raynham.

A Royal Review

OFFICERS and men of the R.N.V.R. will be reviewed by H.M. the Queen on the Horse Guards Parade on June 12th, 1954. The review will mark the fiftieth anniversary of the formation of the R.N.V.R. and each of the 12 General Service and five Air Divisions will be represented.

Naval Wings Presentation

THE Parliamentary Secretary of the Admiralty, Cdr. Allan Noble, D.S.O., D.S.C., R.N.(Retd.), M.P., presented wings to Naval pilots at the R.A.F. Station, Syerston, near Newark, Notts, on Friday last.

This ceremony marked the completion of the pilots' initial flying training in the Fleet Air Arm. Nine of their number now become Upper Yardmen (Air)—men who have been promoted from the lower deck. It is the first time that Upper Yardmen (Air) have been included in a Naval flying training course at Syerston.

Signals Switch

TWO signals specialists, A. Cdres. P. Jones, C.B.E., S.A.S.O., of No. 90 Group, and A. Cdre. C. A. Bell, Chief Signals Officer, M.E.A.F., have exchanged posts. Thus A. Cdre. Bell returns to duties which he performed at No. 90 Group from June 1949 until he went to the Middle East in February 1952.

Before going to No. 90 Group as S.A.S.O., A. Cdre. Jones commanded the R.A.F. Central Signals Establishment and was, before that, Chief Signals Officer at Transport Command. A one-time R.N.A.S. wireless operator and Cranwell cadet, he has the distinction of having been mentioned in despatches no fewer than five times during the last war.

Inter-Command Rugby

IN the final of the R.A.F. Inter-Command rugby competition, Home Command defeated Technical Training Command by a goal and two tries (11 points) to one try (3 points). In the Home Command team were two internationals, F/L. R. V. Stirling (Captain) and F/L. V. R. Tindall. The Technical Training Command team included F/L. G. Rowlands, who scored five of Cardiff's eight points in the recent defeat of the All Blacks.

To reach the final, Home Command defeated Flying Training Command 21-5 and Fighter Command 11-0. Technical Training Command beat No. 90 Group 26-3, Maintenance Command 9-3 and Transport Command 28-6.

Teams were: *Home Command:* S/L. Smailes (Air Ministry); F/L. Tindall (C.M.E.), F/L. Beatson (Wroughton), S.A/C. Barter (Innsworth), F/O. Boothman (Innsworth), L.A/C. Jones (Innsworth), F/L. Holland (Air Ministry Unit, Ruislip), F/L. Stirling (Air Ministry), F/L. Brown (H.Q. No. 66 Group), F/L. Face (Farnborough), F/L. Yarranton (Air Ministry), P/O. Craddock (Innsworth), F/O. Naylor (Netheravon), L.A/C. Dobbs (Pucklcworth), and L.A/C. Jones (Innsworth).

Technical Training Command: A/C. Turner (Yatesbury), A/C. Davies (Bridgnorth), L.A/C. Jones (Henlow), A/C. Keavney (Uxbridge), F/L. Rowlands (St. Athan), F/O. Wilks (Cosford), A/C. Grove (Cardington), P/O. Lilley (Uxbridge), A/C. Hughes (Cardington), P/O. David (Yatesbury), F/O. Williams (Yatesbury), A/C. Sewell (Catterick), P/O. Collard (Locking), F/O. Bleasdale (Halton) and F/O. Collingridge (Cosford). Referee: W/C S. E. D. Mills.

A. Cdre. D. L. Blackford

WITH regret we record the death of A. Cdre. D. L. Blackford, who was Air Attaché at the British Embassy in Washington from 1943 to 1945. He was 58.

After serving as a second lieutenant in the Royal Fusiliers in the 1914-18 war, A. Cdre. Blackford was granted a short service commission, and later a permanent commission, in the R.A.F.

He held a variety of posts. From 1932 to 1934 he commanded No. 32 Squadron and from that unit went to the Directorate of Operations and Intelligence at the Air Ministry. During the years 1937 to 1939 he was Britain's air representative at Geneva and for the first three war years was a Director of Intelligence, Air Ministry.

AT CRANWELL: Air Chief Marshal Sir William F. Dickson, the reviewing officer, presents the Sword of Honour to F/Cdt. Sen. U/Off. L. A. Jones at the graduation parade of the 60th Entry to the R.A.F. College. In addition, F/Cdt. Jones also won the Queen's Medal and four other prizes—the first Cranwell cadet ever to gain such a number.

Naval Prize-winner

ON passing-out from H.M. Cadet Training Ship *Triumph*, Cadet K. Day was awarded the Communication and Aviation Prize. The reviewing officer was Admiral Sir George Creasy, G.C.B., K.C.B., C.B.E., D.S.O., M.V.O., Commander-in-Chief, Home Fleet.

No. 210 A.F.S. to Close

AT the annual dinner of Flight Refuelling, Ltd., Sir Alan Cobham announced that the Air Ministry had decided to close down the jet conversion unit, No. 210 A.F.S., at Tarrant Rushton. The school, which was serviced by Flight Refuelling, Ltd., was opened last year.

Vampire Trainer Accident

ON December 16th, a Vampire T.11 crashed on some farm buildings a few minutes after take-off from Broughton. The pilot, F/O. M. Hills-Jones, lost his life. The aircraft was being ferried to Hatfield prior to being delivered to the Iraqi Air Force.

Naval Appointments

AMONG new appointments announced by the Admiralty are the following: Capt. A. G. A. C. Duckworth to H.M.S. *Eagle* in command and as Senior Naval Officer, Northern Ireland and Naval Director Joint A/S School, Londonderry; Capt. G. B. Rowe to be Naval Adviser to Director of Armament Research and Development (Air); Capt. K. A. Short to command H.M.S. *Illustrious*.

AT HALTON: Prize-winners of the 67th Entry to No. 1 School of Technical Training. Air Marshal Sir Dermot Boyle was the reviewing officer at the passing-out parade. Left to right: Cpl. App. J. Hunt (Pioneer Trophy), L. App. A. H. Khokar (Azhar Memorial Shield) and Cpl. App. P. R. Daughtry (Quinton Memorial Trophy).

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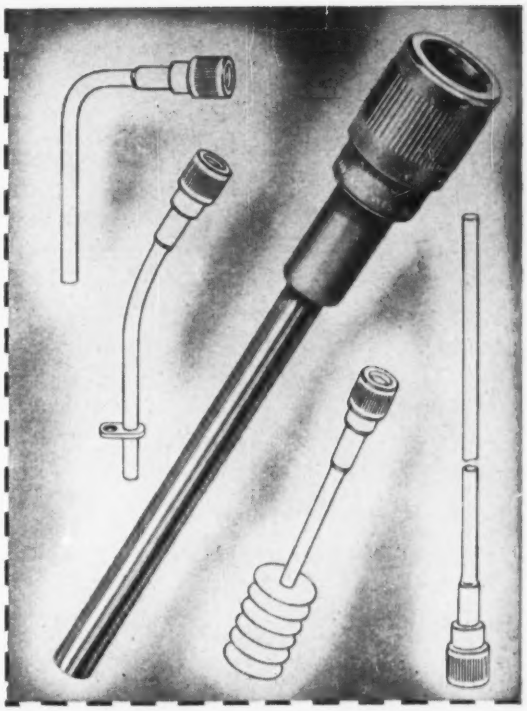

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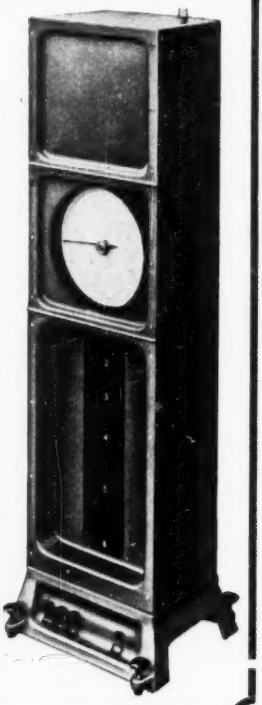

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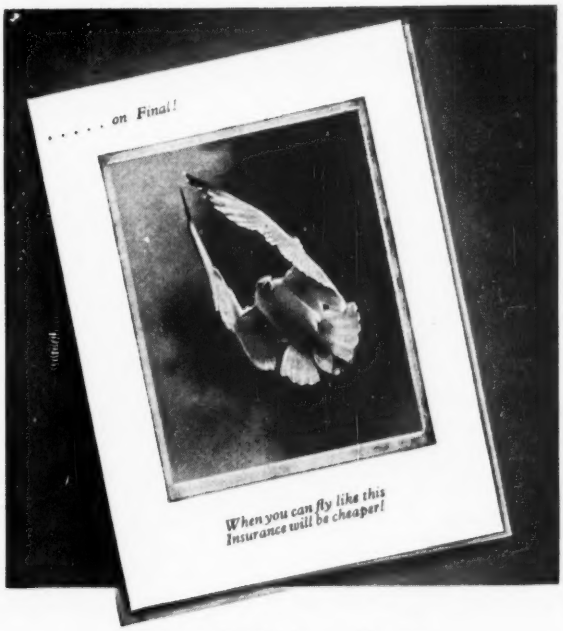

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10X/3880	10X/6054.44	10X/6583.3	110X/6121.11
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10X/4475	10X/6154.5	10X/6694.44	110X/6780
10X/4540	10X/6165.5	10X/6694.5	110X/6861.11
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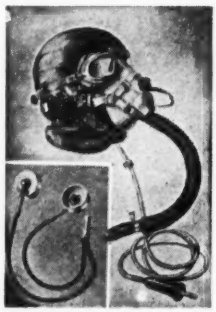

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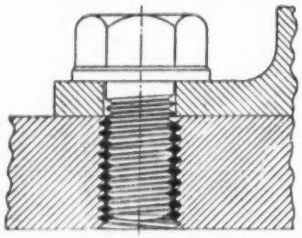

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM: Flightways Ltd., of Southampton Airport, Eastleigh, Hants:—

Application No. 231. For a seasonal normal scheduled service with Dakota aircraft for the carriage of passengers, supplementary freight and mail between Southampton (Eastleigh) and Biarritz with an extension to Tarbes (on demand), at a frequency of from one to two services weekly during the season from March to October inclusive, for a period of seven years commencing March 1st, 1954.

Application No. 232. For a normal scheduled service with Dakota and D.H.89 aircraft for the carriage of passengers, supplementary freight and mail between Southampton (Eastleigh) and Paris (Le Bourget) both direct and with intermediate traffic stops at Le Havre and Deauville, at a frequency of from one to seven services weekly during the period from March 1st, 1954 to February 28th, 1961.

Application No. 233. For a seasonal normal scheduled service with Dakota and D.H.89 aircraft for the carriage of passengers, supplementary freight and mail between Southampton (Eastleigh) and Dinard (Pleurtuit), at a frequency of from one to three services weekly during the season from June to October inclusive, for a period of seven years, commencing June 1st, 1954.

Application No. 235. From Seawings Ltd., of 19 Fenchurch Street, London, E.C., for a seasonal inclusive tour service with Sandringham Flying Boats, for the carriage of passengers and supplementary freight between Southampton (Marine) and Ibiza (Balearic Islands), at a frequency of from one to five services weekly during the season from April to October inclusive, for a period of seven years, commencing April 10th, 1954.

Application No. 236. From Airwork Ltd., of 15 Chesterfield Street, London, W.1. for a seasonal inclusive tour service with Viking aircraft for the carriage of passengers between London (Blackbushe) and Rome (Ciampino), at a frequency of six services at fortnightly intervals during the period from August 7th, 1954 to October 16th, 1954 inclusive.

FROM: Hunting Air Transport Ltd., of 5 Fitzhardinge Street, London, W.1:—

Application No. 237. For a seasonal inclusive tour service with Viking aircraft for the carriage of passengers and supplementary freight between London (Bovingdon) and Bilbao, at a frequency of from one service per fortnight to one service per week during the season from April to August inclusive, for a period of seven years, commencing April 11th, 1954.

Application No. 238. For a seasonal inclusive tour service with Viking aircraft for the carriage of passengers and supplementary freight between London (Bovingdon) and Palma, at a frequency of one service weekly during the season from April to October inclusive, for a period of seven years commencing April 1st, 1954.

Application No. 119/1. From Silver City Airways Ltd., of 1 Great Cumberland Place, London, W.1, for an amendment to the vehicle ferry service which they are approved to operate between Southampton (Eastleigh) and Bembridge (I.O.W.) until December 31st, 1961, for the carriage of vehicles, freight and passengers, to permit the use of Ryde Airport as an alternative terminal to Bembridge and the operation of Dakota and D.H.89 as well as Bristol 170 aircraft on the service.

FROM: Dan-Air Services Ltd., of Bilbao House, 36/38 New Broad Street, London, E.C.2:—

Application No. 239. For a seasonal inclusive tour service with Dakota aircraft for the carriage of passengers and supplementary freight between Southend and Corsica (Calvi), at a frequency of from one to two services weekly during the period from May 30th, 1954 to September 26th, 1954.

Application No. 240. For a seasonal inclusive tour service with Dakota aircraft for the carriage of passengers and supplementary freight between Southend and Innsbruck (for Kitzbuhel) at a frequency of one service per fortnight during the period from May 1st, 1954 to September 18th, 1954.

THESE applications will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections. [1434

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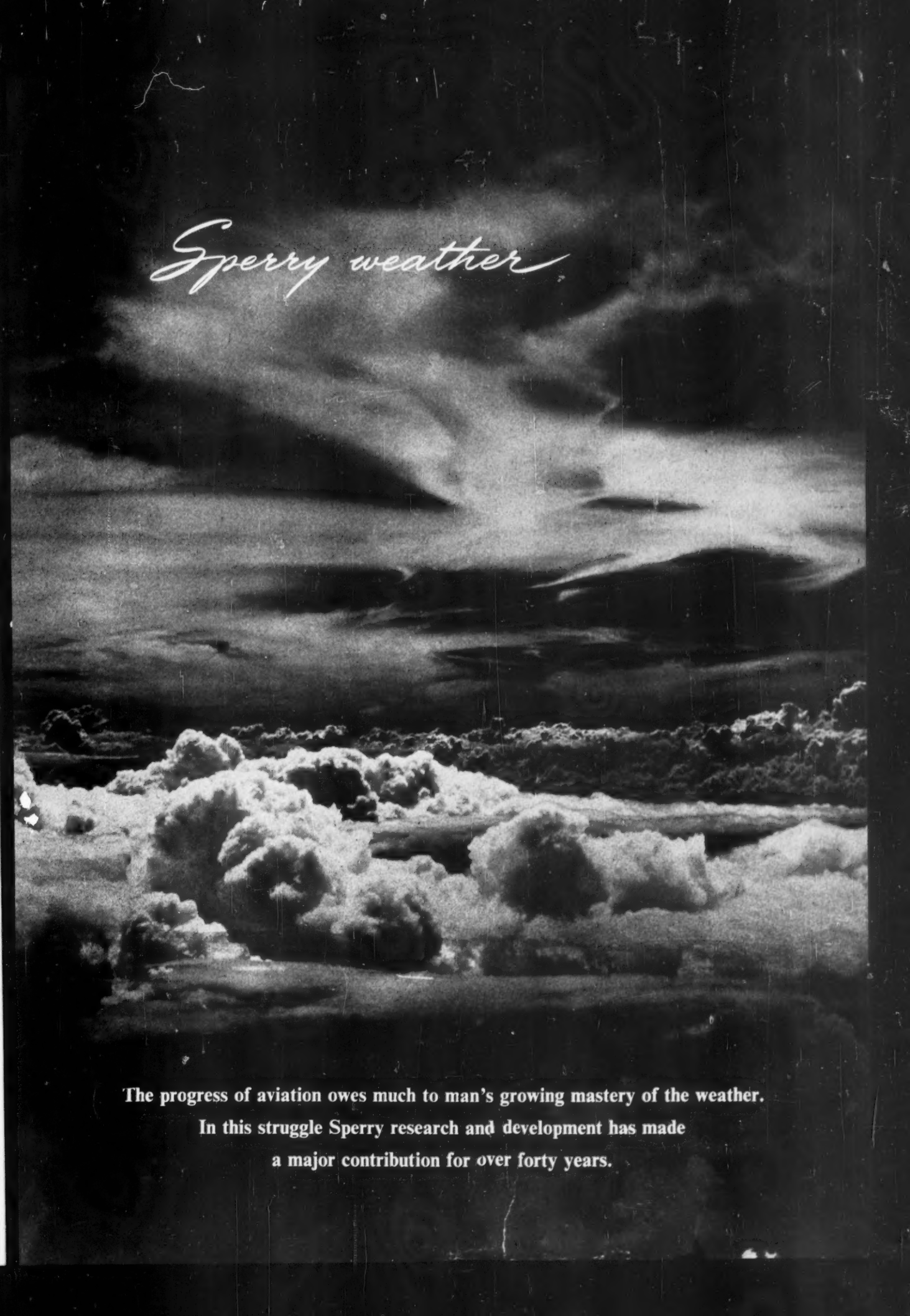

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